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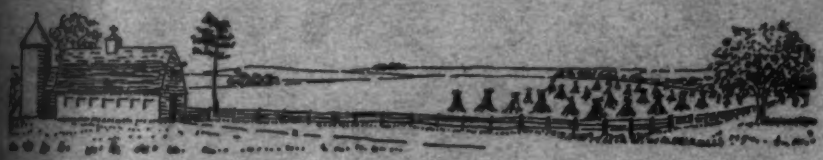

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Volume 6 October, 1942 Number 5

Wartime Rations for Young Calves

Condensed from Farm Science Reporter

Dwight Espe and C. Y. Cannon

A good many farmers who have been in the habit of separating their milk on the farm, sending the cream to market and using the skimmilk for raising their calves and pigs have a new problem now. The demand for more cheese, more dried milk and more condensed milk for the army and navy and for our allies in the war has caused many dairy plants to start turning out these products instead of just butter.

If you happen to be one of those farmers who is confronted with the problem of raising calves now with a reduced supply of milk, you may be interested in some work we carried on here at the Iowa Station to try to find an economical and efficient substitute for milk.

We claim only partial success, because in our opinion no real substitute has ever been found for milk in calf feeding.

This past winter we have been trying out some simple milk supplements. Several kinds were tried, but one gave better results than the others. Because oatmeal is frequently fed to very young children, we used this as the principal ingredient of our successful ration. We then added 1 part linseed oilmeal for each 3 parts oatmeal along with a little salt, bone meal and vitamin supplement.

Here is how we fed these calves. The calves were allowed all the whole milk they needed until 3 weeks of age. This amounted to around ¾ pound daily for each 10 pounds of live weight. At 3 weeks of age the milk was reduced in amount and used in making a gruel. Enough boiling water was added to the oatmeal, with linseed oilmeal mixed in it, to make a thick paste, stirred and then cooled with 3 pounds of milk. The amount of gruel fed depended on the calf. In this experiment 80- to 90-pound calves were fed about a fifth of a pound of the

Reprinted from the Farm Science Reporter, July, 1942, Ames, Iowa

mix (dry basis) twice a day. The milk in the gruel was gradually replaced with water so that the calves were receiving a milk-free gruel at 6 to 8 weeks of age, depending on the vigor of the calves.

A grain mix was accessible to the calves at all times. It consisted of 3 parts ground corn and 1 part wheat bran. They also received all of the best grade of alfalfa hay they would eat.

Gains and Growth

Holstein calves gained 1 pound a day during the 6 weeks of the trial (from the time they were 3 until 9 weeks of age). This is a normal rate of gain for calves of this age. Other breeds did equally as well although, of course, their rates of gain varied with the breed. Although not fat, the calves showed sufficient bloom to indicate a good healthy condition. Their alertness and activity also indicated plenty of vigor. A normal height at withers for their age was further proof that they had not been stunted by this minimum-milk plan of feeding.

The gruel method of feeding takes more time and requires more skill than the usual methods of feeding. However, it is the most satisfactory and economical method of rearing calves we have found when milk is scarce. Of course, we're assuming that skimmilk, whey, dry skimmilk, dry buttermilk and similar milk by-products have become scarce along with whole milk.

Oatmeal gruel as we fed it had two advantages over the other methods which we tried. The pouring of boiling water over the oatmeal mix tends to rupture the starch particles. The heated feed is not only more digestible but the calves like it better. Another advantage of heating is that this oatmeal gruel hardly ever scours calves even though fed in relatively large amounts. Scouring is frequently encountered with calf starters because the finely ground grains tend to escape into the intestine before they have been sufficiently digested.

Although oatmeal is considerably higher in price than ground oats, it has several advantages over the unhulled grain. It contains only 2 percent fiber as compared with 10 to 12 percent for whole oats. Since calves have difficulty in handling roughage at this early age, large amounts of fiber are a detriment. Not only does too much fiber prevent the calf from obtaining the needed nutrients, but it very often causes the calf to scour.

The grain mix we used to supplement the gruel was also very low in fiber. However, the composition of the supplemental grain mix is not as important as its palatability because the calf is consuming relatively small

amounts of it. When the calf is 6 to 8 weeks of age the original supplemental grain mixture should be changed to a regular growing grain mix. Many different feed mixtures have proved satisfactory for growing calves. We have used a mixture of 3 parts ground corn, 3 parts ground oats, 1 part bran and 1 part high protein concentrate (as ground soybeans), along with alfalfa hay, and found it quite satisfactory.

Although hay is almost one-third fiber, the consumption of large amounts of hay has several advantages. Bright alfalfa hay is high in carotene (provitamin A) and vitamin D, two very essential nutrients for the young calf. When hay is not available, fresh grass will take its place, providing plenty of carotene, while sunshine will replace vitamin D.

Commercial feed manufacturers are able to use a variety of feeds almost as readily as one or two ingredients. They are also able to put out a very uniform product with just the needed mineral and vitamin supplements. These are all advantages over the home-mixed feed. On the other hand, the costs of shipping, processing, advertising and selling must be added to the cost of the feed as no feed dealer can be expected to sell feed without a reasonable profit.

The oatmeal gruel we have suggested gave as satisfactory results as any commercial mixture with which it was compared. The cost is low, as oatmeal is now selling for about $3.25 per cwt. while linseed meal costs less. We believe a farmer can save money by making his calf gruel at home.

New Red Clover

In widely scattered tests thruout the portions of the red-clover belt to which they are adapted, the new Midland and Cumberland varieties have produced from one-fourth to a ton more hay an acre than varieties commonly used. Because of their resistance to anthracnose, Midland (adapted to the northern half of the red-clover belt) and Cumberland (to the southern half) greatly lessen the risk of crop failure and the waste of seed and labor, reports J. C. Hackleman, agronomist of the University of Illinois.

—*Successful Farming*

Cutting Corners in Corn Harvest

Condensed from Capper's Farmer

A LABOR shortage resulting from the first World War made the mechanical husker a factor in corn harvest. The machine had been perfected and put on the market 10 years before, but farmers wouldn't have it. Then about midsummer of 1917 they began wondering how they'd get the crop picked. That marked the beginning of mechanization of corn production, altho it wasn't complete until the general-purpose tractor was released about 1925. Until then farmers had to keep teams and men for cultivation and it was logical to use them in the harvest.

But continued labor scarcity and high wages forced rapid acceptance of the corn picker as the cultivation bottleneck gave way to the general-purpose tractor. The margin between hand husking and machine husking costs was wide for several years. But even after wages went down with the depression, farmers continued to use the picker because they no longer had teams, because they wanted to avoid the crews of itinerant huskers, and finally because the machine enabled them to get the crop out in time to do other fall work before cold weather. Development of hybrid corn was also a factor in spreading the use of mechanical pickers because of its sturdier stalks, freedom from lodging and even height of ears.

Carl Paetz, Kossuth County, Iowa, who owns a 2-row, tractor-mounted picker, says it eliminates man power and relieves the fall rush. Outlay for picking 13,000 bushels in 1938, 15,500 in 1939 and 11,000 in 1940 was 2 cents a bushel. Hand husking during those years would have cost 5 cents.

Machines will be relied on to get the crop cribbed this fall wherever they are available, but still there will be a shortage of man power. Consequently ingenuity will be required to get the job done in season. The newer pickers are designed for 1-man operation. With big-capacity huskers, a hauler also is employed and frequently an extra unloader at the crib. But 1-man harvest is possible. By taking extra wagons to the field and towing them back and forth at noon and night with the tractor, a hauler can be eliminated.

Scooping is tiresome and unnecessary. Yet millions of bushels of corn are shoveled every autumn. An elevator will permit a boy or an aged man to do the hauling.

Reprinted by permission from Capper's Farmer, Topeka, Kansas, August, 1942

H. W. Damkroger, Gage county, Nebraska, declared an elevator helped him and a 14-year-old son to harvest crops on 460 acres he farms. Because he doesn't have to scoop it, the boy hauls both small grain and corn.

The Eastern Corn Belt custom of cribbing corn in clover fields where it is fed to hogs the following season offers opportunities for reduced haulage. Gordon C. Hadley, Tipton county, Indiana, uses rail cribs, in a series, 6 feet apart and each holding 350 bushels. His ear-corn elevator is operated by a small gasoline engine. When a crib is full, the elevator is pulled back and rails are laid up for another. A general-purpose tractor pulls the wagon from husker to clover field. For unloading he uses the lift of a tractor manure loader with a special frame replacing the scoop and carrier. The tractor is unhooked from the load, turned around, and the lift raises the front end of the wagon. Thus a 60-bushel load was dumped into the elevator in less than 3 minutes.

"A wagon hoist would do the job, but it's too slow," said Mr. Hadley. "In the time it takes to reset one of that type, I can fill a 350-bushel crib. With only the elevator to roll back and a new pen to make, we can move to a new set in 5 minutes."

Soybean harvest overlapped both wheat sowing and corn picking for Merle Naugle, White county, Indiana. After wheat was seeded, he tackled corn and remaining soybeans by picking in the morning when husks were tough and combining in the afternoon when beans were dry.

Ways have been found to save labor in making silage. First, men to tramp can be eliminated. A binder with a bundle elevator will do most of the heavy lifting. Barring that, low-wheeled wagons or low-slung racks will help. M. C. Chambers, Saline county, Missouri, reduces haulage of both silage crops and manure by setting up wire and paper silos in the field and establishing beef-cattle feeding lots around them.

Both corn picking and silage making have been mechanized by W. C. Allomong, Williams county, Ohio. He and E. M. Schieaber pool labor and equipment in silo filling. A field cutter chops the feed into tractor-drawn wagons, trailers, or a truck. An L-shaped false endgate is set into the silage wagon and is pulled backward by cable and pulley in unloading. This device will empty a 7½- by 14-foot rack body, 2½ feet deep and rounded full, in 5 minutes. Four men, 1 each on the tractor and at the blower and 2 to haul, will put up more silage than 20 did by the old method, Mr. Allomong asserted.

He uses the field cutter in harvesting green corn for steers. "It's a good way to start green cattle on feed," he said. "They harden with the corn and also will go on to silage without setback. Cut corn is fed in bunks."

J. W. Dwyer, Johnson county, Iowa, uses a field cutter in feeding green corn 7 weeks every fall. Thus he harvests 35 to 40 acres of corn ahead of husking time, which relieves his labor and his mechanical picker by that much. The plan might be attractive to other Corn Belt feeders who maintain a crop rotation which calls for wheat to follow corn.

Several years ago experiments in Illinois proved the practicability of saving soft corn by ensiling the ears. Melvin Zauche, Dubuque county, Iowa, did this when his crop failed to ripen. His picker was adjusted to snap ears. W. D. Fribley, Christian county, Ilinois, for several years ensiled ears, irrespective of softness. He considered it a better way to store the crop than in the crib and asserted cattle did as well on the silage as on dry corn.

C. G. Johnstone, on whose McLean county, Illinois, farm the famous system of swine sanitation was given first practical trial, ensiles about 1,500 bushels of ears every fall, at a stage a little riper than for fodder. That amount will feed his normal complement of steers 75 to 80 days when offered with 2 or 3 pounds a head, daily, of hay and 2 pounds of a mixture of 75 per cent soybean and 25 per cent cottonseed meal. The ears are harvested by picker and the stalks grazed off while they are still succulent and nutritious. Aside from getting more feed from stalk fields, he says ear-corn silage is convenient to feed, saves crib room and gets some corn out of the way early.

Hogging corn down is the biggest labor saver of all. The acreage varies from patches to the major portion of the crop on some farms. Carl T. Anderson, Washington county, Iowa, has harvested 100 acres that way. Brood sows are turned in to glean fields after market hogs are removed.

What War Means to the Cattle Feeder

Condensed from Successful Farming

Roscoe R. Snapp

University of Illinois

DURING the ordinary years, beef producers use large amounts of rich concentrates in preparing their cattle for market, but when faced with a long war they try to lower their costs as much as possible by the extensive use of roughages and pasture.

In England, and undoubtedly in Germany and other continental countries, the use of grain and other concentrates in livestock feeding is closely regulated by law. American farmers, anticipating relatively high prices for grains during the next few years, are voluntarily adjusting their cattle-feeding programs to utilize maximum amounts of pasture and harvested roughage and only as much grain as is needed to produce a satisfactory market finish.

Their observations of the fat cattle market of 1941 and memory of cattle prices during the first World War have led them to believe that so long as the present war continues there will be little profit in fattening cattle beyond the degree of finish which will meet specifications of Army purchasing agents and satisfy the meat standards of the rank and file of Defense workers.

Urged by the Government to increase materially the tonnage of beef, cattle feeders wonder what adjustments they can make in their cattle-feeding programs to produce the maximum amount of wholesome, edible beef from the cattle and feeds available, and at the same time secure profits in line with the present high costs of production. Obviously, all feeders will not need to make the same changes in their methods to accomplish these objectives. In fact, some will need to make scarcely any at all, while others will have to reorganize entirely their plan of feeding.

Undoubtedly, the bottleneck in the effort to produce sufficient beef to avoid meatless days and other forms of meat rationing is the number of cattle which will be available for slaughter during the next few years, particularly during 1943 and 1944, when we expect to make our greatest war effort. A threatened shortage dur-

Reprinted by permission from Successful Farming, June, 1942

ing that period may be at least partially averted by carrying over a large percentage of the calves ordinarily fed in Cornbelt feed lots and which under normal conditions are marketed as light yearlings in the late summer and fall.

Farmers who have been full-feeding their calves should consider the advisability of carrying them thru the late fall and winter principally on roughage, grazing them the following summer on pasture, and thus marketing them as two-year-olds instead of yearlings. Such a change of plans would result in delaying their slaughter six to eight months and killing them at approximately 1,200 pounds instead of 900. Thus, each animal would contribute one-third more beef to the nation's meat supply.

One of the principal advantages of this feeding plan is the low cost of production, particularly the relatively small quantities of concentrates required to develop a 400-pound calf into a 1,200-pound bullock over a period of 16 to 20 months. During approximately three-fourths of this time the principal ration consists of roughage and pasture, while during the four or five months' fattening period previous to slaughter, roughage makes up a much larger percentage of the ration of the older steer than it does for calves. Consequently, it is possible to put a 1,200-pound steer on the market with only 35 to 40 bushels of corn, in contrast with 50 to 60 bushels for a 900-pound yearling which is full-fed over a period of eight or nine months. The corn thus saved will be available for feeding other stock and poultry.

No doubt every experienced cattle feeder reading this has made mental comment that a 1,200-pound steer grown for a year or more on roughage and pasture and marketed after a short feed of four or five months would be considerably short of prime condition, whereas the 900-pound yearling full-fed for eight months or longer would be sufficiently well finished to sell near the top of the market. Hence, any saving in feed costs effected by delaying marketing would be fully offset by a lower selling price.

That such a criticism would be logical and much to the point during a period of peace when normal price conditions prevail is readily granted. However, it does not necessarily apply in times of war, when cattle prices are disturbed by abnormal demands.

Army purchasing agents and housewives and restaurateurs who plan meals for Defense workers are not greatly interested in the very highly finished, lightweight beef produced by

market-topping yearling cattle. They regard it as too fat for economical purchase and the cuts too small for serving to a large number of men. They much prefer, particularly at a somewhat lower price, the leaner cuts from heavier, older steers which have been grown out on pasture and roughage after a feeding period of some 100 to 150 days.

These facts go far to explain the relatively small price spread which has prevailed between "low good" and "choice" grade slaughter steers during the past year. A similar situation was experienced during the last war and was largely responsible for the extensive use of limited grain rations in fattening cattle during the winters of 1918-19 and 1919-20. Such rations are being used during the present emergency and will become more common as the war progresses and curtailed supplies of concentrates for livestock feeding compel more and more producers to substitute roughages for high-priced grain and protein supplements.

Prime steaks and roasts along with many other luxuries enjoyed in time of peace must be replaced during war by articles of a more practical nature, which can be produced more quickly and with less labor and materials. The last 100 pounds of weight put on by a steer that is full-fed eight or nine months represents mostly fat which will be trimmed off by the retail butcher before the meat is weighed to the consumer, and by grease drippings which are lost during cooking. Consequently, the feed consumed by the steer while making this gain contributes but little to the actual meat supply of the nation.

Hence, the obvious thing to do in the present emergency is to market a majority of our cattle as soon as they attain a moderately good finish, and use the feed thus saved in fattening more cattle or in feeding hogs or sheep. Three moderately fat short-fed cattle must replace two highly finished long-fed animals in our feed lots and packing plants.

Fortunately, the present emergency finds us with a total cattle population very close to the all-time record. Consequently, supplies should be adequate, provided they are fed into the beef-making machine according to the estimated needs of the nation and not haphazardly according to the desires of individual feeders for the greatest possible profit.

The change in feeding methods which promises the most satisfactory results from the standpoint of both producers and consumers is the use of more corn silage in the rations of fattening cattle. Silage has a number of qualities which make it especially valuable during a national emergency.

In the first place, an acre of corn stored and fed as silage will produce more gain on cattle than an acre of any other kind of feed crop grown extensively in this country. This fact has been demonstrated many times in feeding experiments carried on at the different agricultural experiment stations.

For example, as an average of three trials at the Michigan station, an acre of corn fed as silage to yearling steers produced 494 pounds of gain per acre in comparison with only 366 pounds produced by an acre of ground shock corn.

Probably the most recent acreage comparison between corn silage and sound dry corn was made with two-year-old steers at the Illinois station during the past winter. Steers given a full feed of corn silage gained 900 pounds for each acre of corn consumed in the form of silage, while those fed shelled corn and clover hay gained 470 pounds for each acre of corn utilized during the same period.

That long yearling and two-year-old steers given a full feed of corn silage for four or five months will become sufficiently fat to satisfy the civil population as well as the Army is indicated by the fact that the herd of steers thus fed at the Illinois station last winter showed a dressing percentage of 59.3 in comparison with 60.7 for the herd which received a full feed of shelled corn and clover hay. Altho the carcasses of the latter steers were better finished, the difference was not sufficiently great to be of much importance to the average consumer. However, the difference in cost of fattening the two lots was highly significant—$12.80 a head, a figure which would amount to $307 on a full carload.

Again the experienced cattle feeders reading this article are likely to remark that feed costs per head are only half the story, the other half being the selling price per hundred at the market.

As stated above, war conditions generally operate to decrease the normal price differential between strictly fat cattle and those in average good slaughter condition. Besides, the major objective of every cattle feeder should be to produce the maximum quantity of the grade of beef most essential to the winning of the war, altho doing so may involve a financial sacrifice in the form of reduced profits.

White Scours

Condensed from Guernsey Breeders' Journal

Dr. George H. Wise
S. C. Agricultural Experiment Station

EVERY dairyman realizes the far-reaching importance of preserving the health of young stock. He is also cognizant of the fact that the care of the calves determines in a considerable measure the health of the future herd on which his prosperity depends.

Most prevalent among the many diseases leading to morbidity and mortality among dairy calves are digestive disturbances of various types. One of the most common symptoms of the digestive upsets is some form of diarrhea, often referred to as "scours." This disorder may be the result of one or more causes among which the invasion of germs is perhaps the most conspicuous and most important economically.

Foremost among the diseases resulting from bacterial invasion of the intestinal tract is white scours, an acute malady of the new-born calf. Once white scours is contracted its course is generally rapid and usually fatal, the death rate ranging from 85 to 100 per cent of the untreated cases. This disease is one of the many disturbances incidental to artificial conditions to which modern cattle are subjected. This is evidenced by the fact that outbreaks are frequent in calves dropped in barns but rare among those born in the open pasture. This observation also indicates that the bacterial invasion takes place after birth from the surroundings into which the calf is dropped, rather than before birth in the uterus of the dam, as sometimes believed.

In its most common form white scours is manifested within a period of 15 days after birth of the calf, with the majority of cases appearing within two days. However, in many cases this disorder occurs before the calf is one day of age, and in exceptional cases death ensues within 24 hours without the appearance of the characteristic diarrhea.

The sequence of the development of the symptoms are, in general, as follows:

1. Lassitude — weakness and depression.
2. Dull appearance of eyes.

Reprinted by permission from the Guernsey Breeders' Journal, Peterborough, N. H., August 1, 1942

3. Inactive—prefers to remain lying.

4. Impaired appetite — often refuses to nurse.

5. Temperature high in initial stages but become subnormal in advanced stages.

6. Respiration (rate of breathing) increases as the disease progresses.

7. Diarrhea — evacuations frequently accompanied by severe straining and evidence of pain.

(1) Yellowish or grayish color at first.
(2) Undigested milk curd, white particles, often distributed in fecal material.
(3) Considerable gas present as evidenced by frothy discharges.
(4) Offensive, foul-smelling odor.
(5) Consistency becomes more mucous and watery.
(6) Color gradually changes to a brownish tint frequently streaked with blood.

8. General dehydration of the calf's body as a result principally of moisture losses through watery fecal discharges.

(1) Loss of weight.
(2) Tucked up belly.
(3) Drawn in flanks.
(4) Sunken eyes.

9. Exhaustion, emaciation (wasted condition of the body) and subnormal temperatures in final stages.

The extent to which these characteristic symptoms appear depends primarily on the intensity of the infection and the rapidity of its action. In nearly all cases the course is completed between 12 and 72 hours. Regardless of treatment recovery is rare after the eyes show distinct evidence of sinking into their sockets and the temperature becomes subnormal.

The control of any disease is resolved into two principal measures, preventive and curative, of which the former is preferable and generally recommended.

Control of white scours by preventive measures. — Preventive methods in herds on infected premises are of three general types, the first of which is either the elimination of the causative factors from the immediate surroundings or the isolation of the pregnant cow in a remote area free of the infectious organism. The second preventive procedure is the establishment of immunity in the new-born calf so that the body will be able to resist and overcome the action of the invaders. The third is the retardation of the growth of the organisms in the digestive tract by medicinal administration.

Prevention by sanitation and isolation.—Since white scours is a disease of bacterial origin, generally considered to be contracted from the immediate environment, the removal of the germs from

the infected premises is a feasible control approach. To be effective, sanitary measures must be applied rigidly.

The following hygienic practices may serve to cope with the spread of the malady:

1. Scrupulously clean and thoroughly disinfect the maternity stall.
2. Wash and disinfect the cow immediately before she is placed into the stall.
3. Keep the stall and cow clean and disinfected.
4. Provide facilities to prevent re-contamination by attendants entering the stall.
5. If possible, arrange for the calf to be dropped on a clean, recently disinfected sheet.
6. Remove new-born calf immediately to quarters known to be free from the causative germs.
7. Treat stump of naval cord with tincture of iodine, even though this is not considered to be an important channel for the entrance of the white scour germs.
8. Dry calf and keep it warm.
9. Feed immediately colostrum drawn from the calf's dam.
   (1) Since the mouth is the principal gate of entrance for the causative organisms, draw the colostrum so that it does not become contaminated.
10. Keep the calf isolated until at least one week of age.

Even this laborious and difficult procedure does not insure success. The causative bacteria may invade the calving stalls so thoroughly and adhere so tenaciously that prevention of white scours cannot be achieved by reasonable and practical sanitary measures.

The observation that calves dropped in the pasture and retained there for several days seldom contract this malady led to the adoption of isolation as a control procedure. The pregnant cow, one or two weeks prior to scheduled calving date, is transferred to temporary quarters in an open well-drained area several hundred yards from the barn. Obviously, sanitary precaution must be exercised to prevent the spread of the infection from the barn to the temporary maternity stall. This applies to the cows as well as to attendants, neither of which should go directly from contaminated quarters to the uncontaminated without properly cleansing and disinfecting. With reasonable care, calves born under this system of management do not contract white scours, but the method is rather inconvenient and somewhat restricted in application, particularly in large herds having a limited space available.

Prevention by nutrition and immunization. — A brief insight into the marked vulnerability of the new-born calf to bacterial invasion serves as a logical preface

to a consideration of the second general method of preventing white scours, that is, by the development of immunity. At the time of birth the calf does not have adequate defense against the host of bacteria that too frequently lurk in its new surroundings. This applies not only to infections to which cattle of all ages are susceptible but also to organisms that are harmless to older animals but dangerous for calves, as is the case with the white scour germs.

The readiness with which these organisms become established in the body may be ascribed, in part, to the marked permeability of the intestinal walls of the newborn calf. When this physiological state is considered in conjunction with the virulence of the bacteria and the acute nature of their action, it becomes obvious that any immunizing agent must work rapidly to establish a protective barrier.

The first natural line of defense nutritionally and/or immunologically is colostrum, the milk-like fluid secreted for several days immediately following parturition (calving). These early mammary secretions of the cow provide the calf with its first anti-bodies (protectors against bacterial damage), which readily pass through the permeable intestinal wall into the body proper. These colostral anti-bodies afford a measure of protection against white scour germs but usually are inadequate.

In addition to this immunizing property, colostrum also aids in protecting against white scours by providing an excellent source of vitamin A, of which the body of the new-born calf is exceedingly deficient. It has been revealed that calves from cows yielding colostrum low in vitamin A activity are more susceptible to white scours than those from cows producing a high vitamin A potency colostrum.

From the foregoing facts it may be concluded that in order to utilize Nature's defense most efficiently, the pregnant cow in the latter stages of gestation should be so fed that the colostrum may be rich in vitamin A activity and that this important secretion should be fed to the calf immediately after birth. The earlier this protective food is consumed the less are the chances of the invading organisms gaining a foothold.

Frequently this natural barrier is too weak to withstand the invasion of certain types of germs, in which case attempts are made to bring about immunity through artificial means. The injection of commercial anti-white-scour serum is sometimes satisfactory as a preventive measure. Assuming that the serum is potent, the degree of immunity conferred by

this method seems to depend primarily on two major factors: First, the age of the calf when the treatment is initiated and, second, the types of organisms involved.

The age element is simply the old combat principle of "getting there first with the most." When the calf is confronted with the white-scour hazard, immunity must be engendered immediately after birth in order to gain protection during the most vulnerable period in the life of the individual. The serum, therefore, should be injected subcutaneously within 10 or 15 minutes after birth.

Failures in obtaining immunity may be attributed also to the use of improper defense weapons. The causative germs in white scours may involve several species or varieties; hence it is possible that the serum injected may not have the properties essential to check the particular organisms. Commercial serums have been used successfully over periods of time in certain herds where white scours is prevalent but suddenly became ineffective. This may be ascribed to mutation (sudden change) in the type of organisms. Where these commercial serums have failed, a specific serum made from animals in the herd concerned has been an effective combatant in several instances.

Another method of immunizing the calf against white scours is the injection of from 300 to 700 cc. of either citrated or difibrinated blood from the dam. Although good results have been reported, the technique is rather tedious.

Prevention by medicinal treatment.—In spite of all the sanitary precautions and all the immunizing measures, natural and artificial, the disease frequently appears in calves on farms where the organisms are established. Recently, medicinal procedures have been used satisfactorily as prophylactic measures against white scours. Feeding acidophilus milk, which presumably suppresses the growth of the white-scour organisms in the intestine, has been a successful anti-scour treatment.

"On premises where the disease is causing serious trouble, each new-born calf is given a pint to a quart of acidophilus milk once a day for two or three days, beginning the second or third day after birth, or as soon as the calf has taken the colostrum from its dam. If this milk is warmed to body temperature and given in lieu of a regular feeding, the young calves take it quite readily. Many animals given this prophylactic treatment pass through the critical first two or three weeks of life without developing any symptoms of white scours. . . ."

One serious objection to the

acidophilus milk is the difficulty of maintaining the cultures so that they may be available when needed. One of the most simple and promising white scour preventives is the use of certain chemical compounds belonging to the group known as the sulfanil derivatives. The most efficacious of these substances thus far investigated are sulfaguanidine* and succinyl sulfathiazole**, the latter of which is still in the experimental stage, but has produced encouraging results.

Sulfaguanidine may be given either as a drench, suspended in water, or as a dry powder in a capsule. As a preventive, the dosage schedule recommended per 100 pounds body weight is given in table below.

The calf should not be given more than 15 to 18 grams during a 24-hour period, and the treatment should not be continued longer than two or three days.

Control by curative measures.—Ineffective preventive methods, through carelessness or otherwise, result in frequent outbreaks, leaving curative procedures as the last resort. Until recently attempts to cure white scours have been regarded as entirely futile. If the disease is permitted to progress to advanced stages, obviously the damage is irreparable. Fortunately the foregoing medicinal preventive treatments are also effective as cures if initiated when the disease first becomes evident. Since there is always the danger of failure to recognize or detect the symptoms sufficiently early, the curative treatment is recommended only for farms having sporadic appearances.

Acidophilus milk treatment is one of the preventive measures that also serves as a curative agent for white scours. The sick calves are treated with two to four doses, a pint to a quart per dose, given on successive days. "Results are sometimes miraculous, especially in those calves which are treated soon after symptoms appear. It is not unusual for affected calves to show improvement within two to four days. Even though diarrhea continues in some animals, they appear brighter and do not develop the toxic symptoms so frequently observed after the first or second day. . . . On farms with a very high mortality, losses have dropped to less than 10 per cent immediately after beginning the acidophilus milk treatment."

No. of Dose	Age of Calf	Interval Between Doses	Dosage
First	2 to 6 hours	———	5.0 grams
Second	8 to 12 hours	6 hours	4.0 grams
Subsequent (3 doses daily)	1 to 3 days	Morning, noon and night	2.5 grams

Sulfaguanidine is convenient and effective in the treatment of white scours. Its restorative powers seem to be phenomenal. Since the calves eliminate considerable quantities of fluid during the course of the disease, it is suggested that the sulfaguanidine be administered in a water suspension about one-half pint, to aid in replenishing the water losses. The dosage schedule suggested as a cure is given below.

The treatment is continued until the scours definitely subside. If the administration is initiated in due time, positive evidence of recovery is usually noted shortly after giving the second dose.

After cessation of the scours, the calves may be in a weakened condition, especially if the disease was in an advanced stage before starting treatment. During this recuperation period it is sometimes desirable and occasionally necessary to force feed the colostral milk if the calf is reluctant about nursing. This, fortunately, is rarely the case unless the calf is naturally weak.

Preliminary observations on the use of succinyl sulfathiazole indicate that this more recent addition to the chemical family is also an excellent medicament for the treatment of white scours. Positive recommendations, however, await further investigation.

Though a note on the necessity of exercising extreme care in managing the sick calf may seem superfluous, the desirability of keeping the treated calf in a clean, dry and well-bedded pen free of drafts and cold air cannot be overemphasized. Likewise the value of colostrum as a protective food cannot be overlooked.

*Supplied by Lederle Laboratories, Pearl River, New York.

**Supplied by Sharp and Dohme, Philadelphia, Penna.

No. of Dose	Time Interval	Amount per 100 lbs. Body Weight
First	Initial	8 to 10 grams
Second	4 hours	4 to 5 grams
Third	6 hours	3.0 grams
Subsequent	6 hours	2.5 grams

He Solved the "Hunter Problem"

Condensed from American Agriculturist

Raymond Dunn

YOU land owners who are annoyed by hunters trespassing on your property and breaking down your fences, how would you like to have pheasant shooters come to you in small groups, hunt under your supervision, and pay you $10 per man per day for the privilege? And if the shooting season consisted not of the usual two weeks, but lasted from September through February, with the right to shoot both cocks and hens, with no bag limit, and you received around $3 per bird, wouldn't that seem like good business? That is precisely what Mr. LeRoy G. Garnsey, of Seneca County, N. Y., is doing.

Any one owning land having good cover for pheasants could do the same, *provided:* (1) they were willing to abide by the legal technicalities involved; (2) they were sufficiently good poultrymen to raise young pheasants by the hundreds for stocking covers; and (3) they gave service commensurate with the prices charged.

Mr. Garnsey has about 300 carefully selected pheasants in his breeding pens. To keep these, a permit must be obtained from the New York State Conservation Department. His property is classed as a hunting preserve and as such comes under the New York State Game Breeders' Law, which permits shooting of both cocks and hens for a period of six months each year. To comply with this law, Mr. Garnsey breeds and liberates hundreds of birds before the hunting season starts, and frees from his holding pens throughout the season a number of birds sufficient to keep the population approximately level at all times.

Each bird shot on the preserve is tagged with an indestructible, numbered leg band obtained from the Conservation Department. This band is proof that the bird was taken in accordance with the law. All shooters must have the regular state hunting license.

Both Ringnecks and Melanistic Mutant pheasants are raised. Since the object is to keep the birds as wild as possible, the method of rearing them differs markedly from those of the usual poultry raiser.

"Each breeding pen contains 5 or 6 hens to one cock," Mr. Garnsey explained as he showed me

Reprinted by permission from the American Agriculturist, Ithaca, New York, Sept. 27, 1941

about the premises. "Hens may lay up to 90 eggs a year. Normally, 90% to 95% are fertile and 65% to 85% will hatch. Out of every 100 baby chicks hatched, 75 to 80, under proper management, should reach maturity." Birds are considered mature at about 16 weeks.

For the best birds, setting hens are used as foster mothers, so the young birds can be field-reared. *Field-rearing is the crux of the whole process of producing birds of the best sort.* Mr. Garnsey is raising about 2,500 young birds this year.

In field-rearing, the hen is placed in a coop and the chicks are returned to her. A board is placed before the coop for the first 24 hours, keeping the chicks in with the hen so they will learn to recognize her as their foster mother. For the next two days they are allowed limited freedom in little V-shaped pens, where they learn to obey the hen's voice and return to her when called.

After this period, the hen is kept confined in the coop, but the chicks are permitted to roam at will. They will not desert their foster mother at this age.

In the field, dangers beset the young birds from every side. They are stalked by cats, picked up by crows, and attacked by rats. Hawks sometimes bother and dogs are a hazard. Despite these dangers, the loss among the young birds is not excessive if reasonable watch is kept. Their instinct of self-preservation is sharpened and they are made aware of the dangers of their environment — *they are being taught to survive,* which is the main object of field-rearing.

If fed regularly, the young birds will remain with, or near, their foster mother until 8 or 10 weeks old, but by that time they are approaching maturity and soon will fly away. To prevent this, each set of coops is moved toward a common center, and near this center is a trap. This trap is a wire cage 8 feet wide and 6 feet high, having a funnel-shaped opening. The young birds are caught in this trap and removed to the holding cages.

The other method of rearing pheasants is the incubator-brooder system, which is similiar in many respects to the rearing of chickens. However, the heat and humidity requirements in hatching pheasant eggs differ greatly from those of chickens. After the chicks are dried out in the incubator, they are placed in brooders and left there until from 5 to 15 weeks old. *Brooder chicks must be kept in semi-darkness.* Pheasants are pugnacious birds and if crowded together in ordinary light will pick one another.

From the brooders the birds are placed in covered outside pens where they are "hardened"

so as to be rugged when liberated.

The Garnsey land consists of 300 acres at Burrough's Point, south of Seneca Falls, and a 500 acre duck and pheasant preserve in the Montezuma Marshes. At Burrough's Point, some of the land is in hay, there are a few small cultivated patches and a vineyard, but the greater part is natural pheasant cover.

Before the shooting season starts, Mr. Garnsey has already liberated hundreds of birds to stock the covers. Such liberations, under the eye of a state game inspector, must be made before the state grants authority to do any shooting. "You can't shoot first and *then* release," Mr. Garnsey stated. "The object is to make sure the hunter doesn't shoot state birds. As you have to make your liberations before shooting, you never can take back all the birds that have been liberated. Those that are driven off the property revert to the State and tend to stock adjacent covers which are not on the Preserve."

The hunting is regulated as follows:

(1) The average party is comprised of three "guns" (shooters), and not more than *three* parties are permitted to hunt at any one time. This is done not only in the interest of safety, but because the land is so subdivided that three parties will each have plenty of room without crowding and unworked covers to shoot over.

(2) The fee charged for the hunting privilege includes the services of an experienced guide and a well-trained bird-dog. Hunters may use their own dogs if they wish.

(3) Shooting hours are from 9 A.M. to 5 P.M., and as stated, the season lasts from September through February.

The principal revenue is derived from the fees charged for hunting privileges. The size of such fees depends on the number of guns in the party. Last season they were:

No. of Guns	Fee	Allowed Take
Three	$10.00 each	3 birds per gun
Two	$12.50 each	3 birds per gun
One	$25.00	6 birds

For additional birds shot beyond the above number, the cost is $3.00 per bird.

Mr. Garnsey makes no guarantee except (1) that the covers are stocked with an adequate number of birds; and (2) that if a Preserve dog is used, a sufficient number of birds will be flushed to provide at least the limit in fair shots. The actual bag depends on the hunter's skill. Complaints are rare and a long waiting list usually necessitates the making of shooting reservations well in advance.

Besides the birds raised for his own use, Mr. Garnsey sells pheasant eggs and young birds to other sportsmen for stocking purposes. The demand for these seems to be excellent. Select hatching eggs bring $10.00 per hundred, with a discount for large numbers. Day old chicks sell at 25c each. Poults 5 to 6 weeks old cost 65c to 95c. Progressively higher prices are asked for older birds, mature field-reared birds usually bringing about $2.00.

The demand for such services as those provided by Mr. Garnsey is already well established. A careful investigation of this subject by farmers having the land, and willing to take the trouble to learn the work, might lead to profitable results.

Care of Calves on Pasture

Three ways cattlemen can reduce roundworm infestation of their calves and heifers are by treating with phenothiazine, supplying plenty of milk and providing clean pasture.

Animal pathologists of the University of Illinois College of Agriculture, in making these recommendations, explain that various types of stomach and intestinal roundworms common in Illinois are responsible for much unthriftiness of young cattle stock. Severely infested calves are stunted, underweight, often are anemic and have diarrhea and rough hair coats. For the most part, severest cases are among younger stock—those between 4 and 18 months of age.

Because worms develop better and live longer on a moist pasture than on a dry one, well-drained pastures are usually safer. Where possible, it is well to practice rotational grazing so the young stock can be turned into clean, fresh pasture which hasn't been grazed by other cattle for several seasons. It's also a good idea to group cattle according to age, so young calves do not graze over ground contaminated by older calves and yearlings.

Tests show that generous feeding of milk and other supplements reduces exposure to roundworms because well-fed calves graze less. Also, milk in the diet retards the development of the twisted stomach worm, one of the most important internal parasites.

Since animals in a rundown condition may react unfavorably to phenothiazine, the pathologists advise that treatment be under the supervision of a veterinarian.

—*Shorthorn World*

Sweet Potatoes as Cattle Feed

Condensed from Farm Journal

RIVAL of corn for feeding cattle in the southern states is the sweet potato. The cost of producing sweet potatoes is considerably less (pound for pound) than that of corn. Yields of 200 to 400 bushels per acre are not hard to find.

In a Georgia feeding trial with three groups of Hereford two-year-olds (ten in each group), sweet potato meal produced much higher gains than corn, when fed with cottonseed meal and peanut hay. Corn-fed steers gained at the rate of .898 pounds a head a day; sweet potato, 1.55 pounds per head daily. Said the experiment station report modestly: "Results indicate this will be a good feed to fatten beef cattle."

More of the same is a corn-vs-sweet potato feeding trial with beef cattle in Tennessee. Seven steers in one group, fed dehydrated sweet potato meal, gained 1.41 pounds per head daily; seven in another group, fed corn-cob-husk meal, gained only 1.28 pounds per head daily. The trial lasted 150 days. It cost $11.53 to put 100 pounds gain on the sweet-potato-meal steers; with corn-cob-husk meal, $12.73. Both groups of steers had corn silage and cottonseed meal.

In Texas trials, dairy cows were switched back and forth from ground corn to sweet potato meal by what is called the "reversal" method; that is, one bunch of cows ate the sweet potato meal ration for 28 days, while the other bunch ate ground corn. At the end of the 28 days, the two groups traded rations, and at the end of another 28 days, traded back again.

The results indicate, to borrow words from the official report, that sweet potato meal has about 91% of the feeding value of yellow corn as a carbohydrate feed for milk cows; that it is a palatable feed; that it does not affect the taste, flavor or aroma of milk even when fed in rather high quantities; and that it will improve the nutritional value of milk or butter in the vitamin A content over that of yellow corn. Because sweet potato meal is considerably higher in carotene or vitamin A value than yellow corn, it would be a valuable feed for dairy cows in fall and winter months—not only to supply vitamin A, but as a means of maintaining the natural yellow color of milk and butter in off-pasture season. —*Farm Journal*

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Value of Good Roughage for Horses

Condensed from Percheron News

G. W. Salisbury
Cornell University, Ithaca, N. Y.

THE problem most livestock men in the Northeast are faced with today is that of deciding what to do with the feed they have on hand. All farmers would like to use it so that it will contribute most to the "Food for Victory" program. The immediate reaction is to feed it to dairy cows, hogs, beef cattle, or sheep. These animals rapidly convert the feed available into edible products. It is more difficult to assay the immediate contribution of the horse to the Victory program and thus he is apt to be overlooked in the calculations.

One need but look up recent census figures to appreciate that, after all, about three-quarters of all farmers in the United States do not possess tractors. This fact alone makes it obvious that a vast amount of work is done and will continue to be done by horses during the war.

It also seems probable that it will be necessary to feed horses only as much as they earn, for there promises to be great competition between man and his livestock for every available ounce of food. Consequently, one should feed horses no more than they need. On the other hand, the feeding of less of the proper nutrients than are actually needed will result in decreased efficiency and a loss of time and energy on the part of the horse and his driver.

In addition, we must determine what feeds are available locally and their relative costs. Ordinarily in the Northeast we have plenty of roughage, not all of which is of the highest quality. Ordinarily we are short on concentrated feeds and must buy them. It is obvious that our greatest dependence must be placed on roughage for growing out our young stuff.

In this connection some consideration must be given to the question of how big a mature horse is desired. Not all of the ultimate mature size of a horse is due to feeding level, but final size may be controlled to some extent by controlling the level of feeding during development. Often breeders ask, what rate of growth should I expect from my colts? We have been keeping data on

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	Sex	Birth	6 mo.	1 year	2 year	Mature (7 years)
Purebred Percherons (before 1930)	37 Mares 36 Geld.	129.7 135.1	600	850	1,200	1,500
Purebred Percherons (after 1930)	30 Mares 23 Geld.	157.3 157.9	675	990	1,350	1,700
Grade Percherons	44 Mares 42 Geld.	117.4 117.1	540	785	1,080	1,400

this question at Cornell since 1904. In that time we have observed and measured quite a large number of horses. The following table gives the birth weights for males and females and for both mares and geldings combined at several periods in development.

These data show what may be expected from Percherons which are raised with care, but without pampering. Most of them were creep-fed on pasture their first summer, and received limited grain and good quality hay their first winter. As yearlings most of them also received limited grain throughout the year. As two-year-olds they were on pasture during the summer with no supplemental grain and were fed only hay during the winter. This hay was fed in racks in an open shed-barn in which the youngsters might run in and out at will. Just before breaking to harness they were fed some grain to condition them.

Most foals get a good start on the mare. This is because mare's milk supplies the nutritive requirements of the foal. Mare's milk supplies plenty of high quality protein and is high in energy because of its high sugar content, though it is lower in total digestible nutrients than cow's milk, for it is lower in fat content. In addition, it supplies adequate amounts of the proper minerals and vitamins.

When the foal is weaned this rich supply of nutrients is shut off and must be replaced in so far as possible. This difficulty may be overcome to some extent by teaching the foal to eat grain and good quality hay before weaning. It is usually advisable to creep-feed foals on pasture during their first summer with a mixture of whole corn and oats. Even after weaning, such a mixture is satisfactory for foals on good pasture, for the pasture itself supplies the necessary protein, minerals and vitamins. If not on pasture, a good quality, early-cut hay should be supplied to meet these needs. Certainly corn and oats, fed with the usual quality of timothy hay, are not sufficiently high in protein to meet the needs of growing colts and fillies. In this event some source of protein must be added to the ration. Mixtures made up of 2 parts oats and 1 part bran;

2 parts each of corn and oats, and 1 part linseed oil meal are satisfactory. In the East we make use of a mixture of 3 parts oats, 3 parts barley or corn, 3 parts wheat bran, and one part of linseed oil meal. This mixture is widely used by dairymen for growing heifers and may be used with equal success for growing horses.

However, one should not overlook the fact that roughage of good quality is the cheapest source of nutrients on the farm. Even timothy hay, if cut sufficiently early, is a good source of protein for growing animals, and should be used to reduce the cost of growing out the young stuff. Green, leafy hay, cured in the sun, has other advantages in growing out colts with firm dense bone and freedom from unsoundnesses which should not be overlooked. The experience of the U. S. Army in the Philippines and in the Canal Zone as well as experiments at the Michigan station emphasize this point. The Army was plagued by numerous unsoundnesses and shifting lameness in their animals until they found that they were feeding an unsatisfactory ratio of calcium to phosphorus. Apparently horses suffer more from an upset in the calcium-phosphorus ratio than do other farm animals. A ration containing only 1 part of calcium to 1½ or more parts of phosphorus led to disaster; all sorts of bone disorders and lameness resulted. This was due to feeding timothy hay and a concentrate mixture containing an undue proportion of rice bran which was high in phosphorus. Alfalfa hay used in place of the timothy previously fed resulted in righting the calcium-phosphorus ratio and in great improvement of the horses.

In addition, Dr. W. M. Mitchell of the Royal (Dick) Veterinary College in Edinburgh, Scotland, has reported that many of the common unsoundnesses are probably associated with an insufficient intake of Vitamin A. This may be supplied by hays of green color for the precursor of Vitamin A, carotene, is found associated with the green color of plants. In this connection the experience of the Finnish cavalry during recent years is interesting. Klemola, a Finnish veterinary surgeon, reported that the feeding of hay stored for several years resulted in serious injurious effects on the feet of horses. Dense hard horn was again developed when the ration of these horses was supplemented by grass silage, pasture grass, or cod liver oil, all good sources of carotene or Vitamin A. This experience serves to emphasize the importance of pasture and good quality hay if we expect to raise horses that can take their place in this work-a-day world.

Many breeders ask about the necessity of feeding mineral mixtures to growing colts. Additional minerals are not needed when a third or more of the roughage is legume hay and a concentrate mixture is fed. If poor roughage grown on run-out land is to be fed, a mineral mixture may be needed. There seems to be no reason why complex expensive mixtures need be used. A mixture of 40 pounds ground limestone, 40 pounds steamed bone meal, and 20 pounds of common salt is sufficient. As far as is now known, no additional minerals are apt to be lacking, though in some regions there may be a lack of iodine in the soil. Unless foals are born with "big neck," indicating an iodine deficiency, there appears to be no reason why breeders should spend hard-earned cash for this mineral. In this connection, it should be mentioned that the feeding of potassium iodide to the brood mare during late pregnancy has seemingly been effective in reducing the difficulties from navel ill in the new born foal.

There are no definite rules for determining the amounts of feed to give developing colts. Here we make it a practice to give them all the roughage they will clean up and vary the concentrate allowance according to the rate of gain desired.

In experiments conducted at Cornell some years ago the following amounts of feed were fed to colts and fillies that weighed an average of 1,300 pounds at three years of age:

	Grain pounds	Hay pounds
Sucklings	180	
Weanlings	1,200	1,600
Yearlings	1,500	2,500
Two-year-olds	1,900	2,800
Total to three years	4,780	6,900

At present market feed prices this would amount to $160 worth of feed. Additional costs of raising would bring this figure up to well over $200 for a three-year-old ready to work. This is too high and could be reduced considerably if one were to follow a program investigated at the Michigan station. In the Michigan experiments foals have been raised on limited grain rations as compared to full feeding of grain. According to present prices the full feeding program would cost breeders in this area about $225 for feed alone. On the medium grain intake the cost would be $166, and on the low grain in which the horses were fed 2,580 pounds of grain up to three years of age the cost for feed would be but $130, at present prices. Later these same investigators have raised colts almost entirely on roughage and report fairly satisfactory results. It is only fair to add that the colts on the high and medium grain levels were big

enough to go to work as two-year-olds which would reduce this expenditure somewhat. Nevertheless this investigation points out that satisfactory horses can be produced on a limited grain intake, though it takes longer to have them ready for work.

In this section it is my opinion that the breeder of horses should raise his young stuff as cheaply as possible by making the greatest possible use of pasture and hay and keeping the cost of purchased concentrates at a minimum.

The breeder of horses is everlastingly plagued with the problem of parasites unless he has a satisfactory control program in operation. Heavy parasite loads increase the cost of feed needed to develop young horses and decrease the efficiency of the same horses when they are put to work.

We have been interested in this problem for several years and have finally developed a program which appears to work. By use of this program we have not only reduced the parasite infection in our foals, but also improved our pastures. By its use we have entirely eliminated the cases of scours in foals which we found so hard to clear up previous to the inauguration of the program.

We practice rigid barn sanitation. The manure is removed each day from the box stalls where the mare and her foal are kept. The stall is bedded daily with either straw or sawdust. Just before the mares go on pasture each spring they are treated with phenothiazine by the veterinarian. The foals are not treated. Then the mares and foals are placed on a pasture lot and stay there only three weeks, when they are changed to a clean fresh pasture. The first pasture then is used by the geldings and open mares at night or when they are not working. After this the pasture is rested for at least three weeks. Each pasture is used in this fashion first for mares and their foals, then for the open mares and geldings, and is finally rested, following which it is available for the mares and foals again. At the end of each three-week period the manure spots in each pasture are spread by means of a chain harrow. Occasionally it has been found necessary to clip with a mowing machine the coarse pasture grass around the manure spots in order to stimulate the growth of fresh green grass.

The rest period of three weeks is given each plot for two reasons. First, because horses eat so close to the sod that it is necessary to give the grass a chance, and, secondly, to enable the lethal effects of sunlight and drying winds to get in their innings on the eggs and developing lar-

vae of the strongyle worms. We have found that the kill is relatively high during the three-week period and effectively reduces the number of potentially infective larvae, especially if the manure clods are well broken up.

In our set-up here we have only about 40 acres of pasture for our entire group of some 50 horses. This area has proved sufficient under this system of rotational grazing except for the dry summer of 1941. The pasture itself has improved under this system of management and the parasite infection has been decreased one-half by this method as compared to the decrease resulting from treating the mares only. When these investigations were started in 1938 our foals carried an infection measured as 1,900 parasite eggs per gram of feces four months after weaning. In 1939 when treatment of the mares before going on pasture was used the infection was 900 eggs per gram of feces. In 1940 when rotational grazing was added to the program the average infection was only 500 eggs per gram.

Not only was there a marked difference in the number of parasites carried by the foals but a marked difference in the appearance of the foals. They are heavier at the same ages and have a thriftier, more rugged appearance.

It would be unwise to conclude this discussion without a statement regarding the advisability of handling the young stock frequently enough to check on the development of their feet and to trim their feet when necessary. All good horsemen know that this is a desirable practice. Too few horsemen practice it!

High-Vitamin Grain

Condensed from Missouri Ruralist

INDUSTRIAL science has created a new 9-hour test for 2 essential vitamin elements found in farm crops, research chemists for General Foods Corporation report. The old biological methods were expensive and required several weeks. But the new "test-tube" technique takes only one day to disclose in wheat and corn the exact amount of both thiamin and riboflavin—important elements of the vitamin B complex. Vitamin B has been

Reprinted by permission from the Missouri Ruralist, March 28, 1942

called the "war nerves" food ingredient. It is being used increasingly in Britain.

This discovery promises nutritional advances and perhaps new American farming and marketing standards, it was said. It comes on the heels of a recent report revealing a possible new boon to military surgeons in "pectin therapy" for the quicker healing of wounds, using a natural ingredient found in fruits such as apples.

The new 9-hour test-tube discovery not only saves time and money for the food industry, but also may establish new agricultural and market standards for foods popular in U. S. diets.

For example, the studies reveal that soil, locality, variety, and environmental conditions during the growth of wheat and corn show "a marked effect on the vitamin content of these grains. . . . Such a study by the older biological methods would have been almost prohibitively expensive and laborious." The new method will enable farmers to weigh the influence of soil and climate on the vitamin content of their grain crops, and thus grow the varieties of greater benefit to consumers.

In the future these farmers, aided by government workers and agricultural school experimenters, will be encouraged to breed strains of grain having the highest vitamin and mineral content, just as millions of tons of American grains now are developed for resistance to disease and for yield.

Medical authorities agree that many American diets require a greater volume of the vitamin B complex, and also that this is best obtained in foodstuffs at the family dinner table.

Advantages of Constructing Terraces With a Plow

1. All farmers have the necessary equipment, and it is always available when conditions are right for terracing.
2. Labor and equipment costs are low.
3. Farmers understand the operation of a plow.
4. Terrace cross-sections are uniform, and areas of exposed subsoil cause little variation in terrace height.
5. Equipment slips very little on curves.
6. Wide channels and ridges, which are so important in terrace construction, are easily obtained with a plow on 1- to 6-percent slopes.
7. Moving of terracing equipment from farm to farm is eliminated.

Plow Method of Terrace Construction

Condensed from Soil Conservation

Paul M. Pittenger

Assistant Soil Conservationist, Montgomery County Soil Conservation District, Hillsboro, Ill.

EXPERIENCES of farmers and Service personnel in the Montgomery County Soil Conservation District (Illinois) show that the ordinary plow—tractor, horse-drawn, riding, or walking—can be used successfully in the construction of terraces. The use of this equipment, some of which is found on every farm, will simplify the job of getting terraces established on the land.

Most terracing equipment is rather expensive and has very little use except for the one purpose, which means that only a few individual farmers ever will own such machines. This fact has made it desirable that we develop a method of terrace construction to utilize ordinary farm equipment.

Terraces are being built in the Montgomery County district with the ordinary farm tractor and two-bottom plow as rapidly or more rapidly than with a small 6- or 8-foot blade grader. One man handles the equipment and very little supervision is needed because all farmers know how to use a plow—they need only a staked terrace line and a demonstration of the system of construction. Twelve miles of terraces were constructed in the district by this method during 1941, while only one-fourth mile was constructed with a blade.

Terraces on 1- to 6-percent slopes, to be constructed from both sides, are started by turning furrows downhill. The stakes represent the center line of the terrace channel, and the first furrow should run 3 to 5 feet below the stakes. With some equipment it is necessary to start plowing about 5 feet below the stakes to avoid knocking them down on the first through.

The stakes are then reset about 12 feet down the slope to guide the return trip on the downhill side. This return trip leaves an "island" 10 to 12 feet wide. From this point, the construction follows a rather definite system of overlapping each three trips on the upper side of the "island" and each six trips on the lower side. By following this system, a "wave" of soil 6 fur-

Reprinted from Soil Conservation, July, 1942, Washington, D. C.

rows wide will be pushed over the "island" from the upper side, and a wave of soil 12 furrows wide will be pushed over it from the lower side. Usually the terrace is complete when this "island" is plowed out, or covered, and the waves are well lapped together.

The plowing must be deep in order to give the terrace sufficient height. This can be done by keeping the tractor or team well up on the loose soil. Twenty-four rounds usually will complete a terrace. One additional round is then made—one trip at the upper base of the ridge and one trip at the lower base of the ridge, with the rear plow set shallow — to help develop a more uniform cross section at these points.

The terrace channel is established when the island is covered, so it is important to have it of sufficient width to form the desired channel. A 12-foot island will form an 8- to 10-foot channel. When plows of sizes are used, the number of trips is varied to form a wave of soil of approximately the same width as that formed by a two-bottom 14-inch plow. A two-bottom 12-inch plow works best in series of four trips on the upper side and eight trips on the lower side.

When the above procedure is followed the terrace should have approximately the following dimensions: Bottom width of channel, 8 feet; settled height of ridge, 1.1 feet; width of ridge, 24 feet; and total disturbed area, 38 feet. Additional height can easily be attained by back-furrowing.

Terraces on slopes steeper than 6 percent usually should be constructed entirely from the upper side. Starting the terrace on these steeper slopes is the same as for less steep slopes, except that the island should be only 6 to 8 feet wide. Operations in completing the terrace will be similar to those followed in constructing the terrace from both sides, with the exception that the field is plowed below the terrace on return trips and a wave of soil is not brought from the lower side to cover the island. Usually, two-thirds or more of a terrace interval is plowed below the terrace by the time the terrace is completed.

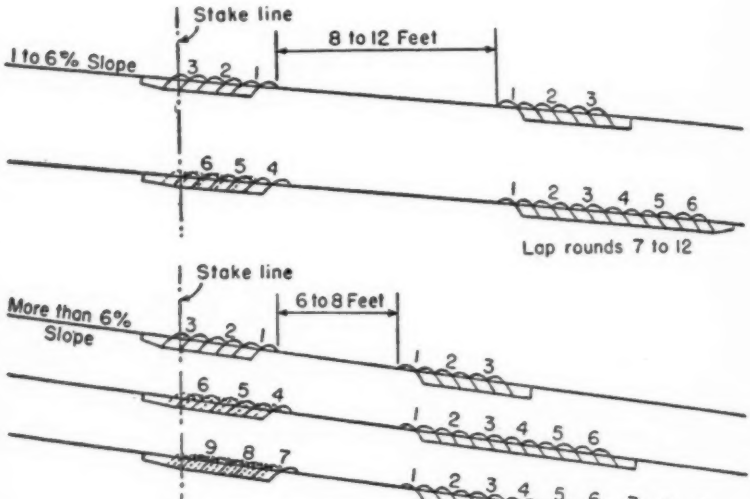
Ed Battles, a key cooperator in the Montgomery County district, constructed 1,500 feet of terraces from the upper side with five horses and a two-bottom 12-inch plow in the spring of 1941. He said: "I had my field almost plowed when the terracing was finished and it worked mighty slick."

The district recommends that all terraces be made with a plow. Farmers have been constructing them at the rate of 150 to 250 feet per hour with two-plow tractors, and as much as 400 feet per hour with three-plow tractors.

A few terraces have been constructed with walking and riding horse-drawn plows.

Land free of vegetation and with a considerable amount of moisture always works best in terracing with a plow. Where considerable vegetation is present, it usually is desirable to mow and rake the areas to be plowed; however, high-clearance plows can operate where there is considerable trash, provided the jointers, and sometimes the rolling coulters, are removed. Vegetation will cause the most difficulty the second time it is turned. To lessen the difficulty, the first plowing should be shallow, and the following trips should plow twice as deep as the first, especially on the upper side of the ridge and in the channel.

Terraces may be constructed from both sides or from the upper side only. On slopes steeper than 6 percent, they generally should be built from the upper side only. Slopes of 1 to 6 percent may also be terraced from the upper side, but construction from both sides usually gives the most desirable cross-section on these slopes.



Terraces on slopes over 6 percent are built from the upper side only. The "wave" is three furrows wide to cover an "island" 6 to 8 feet wide. Return trips just plow below the terrace.

Machine Milking Put on a Time Schedule

Condensed from Farm Research

A. C. Dahlberg

MILKING machines were developed to save labor. In New York State about one-half the total farm income comes from the dairy cow and the greatest labor problem on the farm is milking. Any procedure which can reduce the amount of labor, especially if it improves the quality of milking, is of vital importance in the War effort to produce more milk and to save labor. Hence, the research with the Station herd to milk cows in less time is especially opportune.

The Experiment Station herd at Geneva has been milked continuously by machine longer than any other dairy herd in the United States. The first milking machine was installed in 1907 and the herd has been milked by machine since that time. The experience with the Station herd covers that of the modern milking machine almost from its beginning. The development of the milking machine extends over a period of a hundred years, but modern designs hardly cover half that time.

Ever since the introduction of milking machines there has been a belief among dairymen that they tend to "dry up" the cows and cause mastitis. This idea has continued even tho most of the published investigations show it to be erroneous. In 1912 this Station published one of the best studies of that time showing that machines had no effect on milk production. At that time few herds of dairy cows were maintained in sufficiently uniform condition to secure reasonably accurate data extending over a period of years. Later, a test was planned that covered more than 10 years to determine the influence of machines on milk production. The data, published in 1935, clearly show that milk production was decreased by machine milking under the conditions of the experiment.

It is difficult to secure reliable data on such a problem. A herd must be available in which conditions are quite comparable from year to year so that every other factor than the method of milking is held as constant as possible. It is necessary to avoid abortions, serious mastitis, and indigestion. Other factors which must be controlled are age of the cows, length of the lactation and dry periods, management, and feeding variations.

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In 1935 another milking experiment was commenced the results of which were published in 1941. It was thought that the poorer results secured by machine milking might be due to slow milking. The bulletin published in 1912 gave 11.7 minutes as the average time required to milk each cow and transfer the machine to the next cow. This milking time had been reduced slightly in the tests reported in 1935. An effort was then made to reduce the milking period materially. Little progress was made by saying that the cows would be milked in less time because the men and the cows were both in the habit of slow milking and there was no way to judge time. To overcome this difficulty a timer was installed which rang a bell automatically after a specified interval. When the bell rang the machine was removed and the cow stripped by hand.

The time interval for the machine to be on the cow and to remove it and place it on the next cow was first set for 8 minutes. One man ran two single units, but a second man was needed for a few days for stripping. The first day on this schedule the average strippings per cow were 1 quart. Three weeks later the strippings were 1 pint per cow. After two months the time per cow was reduced to 6½ minutes where it was left for several years. It is now 6 minutes per cow and in 1 hour one man milks, strips, and weighs the milk from 20 cows.

Additional Observations

Several observations are of special interest. Heifers milk out readily in 4 to 5 minutes so the total time of 6 minutes is ample. Old cows adjust slowly to faster milking, but they can be trained. Massaging of the udder at the end of the milking period before removing the machine has been discontinued. It is believed to be a poor practice. All cows have adjusted to the faster milking schedule, in fact the time per cow has been reduced from 11.7 to 6 minutes. The amount of strippings has been reduced. Only one cow in eight or ten requires hand stripping, but all cows are tried by hand to see if they are dry. This means that in the Station herd of 30 milking head there are three cows that require hand stripping. The hard-milking cows have become more easily milked. Most of the cows milk out in less time than allotted, but a man cannot work faster. In other words, the man works at full speed to handle two single units.

As shown in Bulletin No. 697 of this Station which is available for distribution, milk production held up better under the system of more rapid milking. Furthermore, since this schedule was commenced, the incidence of mastitis in the herd has been less

than ever before and the milk shows a healthier udder condition. This observation on mastitis may be accidental, but it has continued since 1936 to date.

More rapid machine milking means time saved and more milk produced. The problem of a short milking time is not an easy one to solve and may vary from farm to farm, but it is evident that operators of milking machines should try to work uniformly and rapidly without giving extra time to milk special cows. A clock or a radio are both being used on some farms to give the milker a chance to observe time. Five cows per 15 minutes for one man operating two single units is about right. If the milk is not removed quickly by machine, it is best to remove the machine and milk by hand.

Maintaining the Built-Up Litter

Condensed from Everybodys Poultry Magazine

A management idea that will cut your labor and litter expenses, help to maintain a warmer laying house in cold weather, result in fewer soiled eggs, because of dry litter, and avoid scaring birds by frequent litter changes.

When to Start

Get it underway in the summer, about August or by the middle of September, before wet weather sets in. The built-up litter, however, can be established later by using a finely cut litter material or by using up to 1 inch of dried sand as a foundation. The sand must be thoroughly dry.

Kinds of Litter

A variety of materials can be used. Among them are shavings, straw, peat moss, sugar cane litter, peanut shells, oat hulls, ground corn cobs, and other materials which will break up easily.

Operating the Plan

When the pullets are being housed, spread a thin layer of litter, about 1½ inches, over the floor. As this breaks up, add additional litter. By November, or the time cold weather sets in, the litter should have reached a depth of 4 inches.

The finely broken material on the floor acts as an insulator, preventing the moisture-laden, warm air of the pen from coming in contact with the cold floor and condensing to cause wet litter. Absence of this fine carpet of insulation is the most common cause of wet litter in hen houses during winter months. Of course, good ventilation is essential to take away the moisture given off by the birds and also resulting from the evaporation of drinking water.

Don't add additional litter until that already on the floor has

Reprinted by permission from Everybodys Poultry Magazine, Hanover, Pa., July-August, 1942

been well broken up. This is particularly necessary with straw, which does not become highly absorptive until it is broken into fine pieces.

6-Inch Limit on Depth

Don't let the litter become more than 6 inches deep. It is desirable to remove some of it in order to have some fresh litter on the top. Some poultrymen remove several inches of litter in the late spring, so that the annual housecleaning a few months later in preparation for another crop of pullets is not quite so big a job.

Keep It Stirred

Keeping the litter stirred or turned is an important step in maintaining a built-up litter. A hay fork can be used. Feeding some of the grain on the floor helps to keep it loose and dry. Litter scratched to the rear of the pen should be brought forward and spread evenly.

Wet litter around fountains or at the front of the pen should be replaced with dry litter from other parts of the pen.

Precautions

If the litter is dry in midwinter, don't be tempted to change it, or you'll have to do it at regular intervals during the remainder of the winter.

Don't crowd the layers. Allow 3 square feet of floor space per bird for Leghorns; 4 square feet for dual purpose birds.

Properly cared for, the built-up litter should last the full 10 or 11 months the pullets are in the laying pens.

Balbo Rye

The rapid and nutritious fall and spring growth of this new rye has endeared it to dairymen and produced a rush of buyers in Missouri, Nebraska, Iowa, and other states. It is ready for pasture 10 days to two weeks ahead of barley and other small grains in the spring. In the fall it is ready for pasturing four weeks after seeding. Tests at the Missouri Experiment Station show that milk of cows on this crop was as free of taint or off-flavor as the milk from cows on good bluegrass pasture. Several cheese factories and milk plants have obtained seed supplies to sell to their producers at cost. Since this rye fades out in May, it makes a good nurse crop for Korean lespedeza. The variety does well on the less fertile soils, producing upright growth, and under Missouri conditions it is fully winter-hardy. In Nebraska its hardiness is satisfactory, but unequal to Rosen, Dakold, and Nebraska Common. Buyers should obtain seed only from reliable sources. Balbo was tested and developed by the Tennessee Experiment Station.

—*Successful Farming*

Spray Painting of Farm Buildings

Condensed from Agricultural Engineering

L. A. Buse

Associate A.S.A.E.

LIKE many other insurance companies, our company acquired a large number of middle western farms as an aftermath of the inflationary period which followed the first World War. After acquiring the farms, the immediate problem was to rehabilitate them promptly so they could be restored to individual ownership. Fences had to be repaired, drainage systems cleaned, and the buildings repaired and painted. The repairs were a comparatively simple problem once an organization was built up to make them.

The painting problem was somewhat more difficult, however, as most of the buildings had not been painted for a number of years. This lack of protection had permitted the exposed surfaces to become checked, cracked, and extremely porous which resulted in a very shabby appearance. In spite of large amounts spent for repairs the restored buildings still looked shabby. Repainting was badly needed, not only from a preservation standpoint, but also to provide the attractive neatness which is a mark of character and good standing in most rural communities.

Spray painting was recommended to us by an equipment manufacturer. We tried it on a contract basis on a few jobs with unsatisfactory results. The finished product did not compare in quality or appearance with brush paint work. We did learn, however, that the painting could be done much faster, and that if a satisfactory spray paint system could be worked out, the time required for completing our painting program could be shortened by at least two years.

In order to make a careful investigation of the possibilities of spray painting, we designed and purchased a complete outfit. Farm men with some painting experience were hired to operate it. A factory representative spent several days with these men, explaining the use of the equipment and experimenting with various paint. The experience of one of the federal land banks with spray painting was checked. Dr. F. L. Browne of the U.S.D.A. Forest Products Laboratory was called upon and furnished some

Reprinted by permission from Agricultural Engineering, St. Joseph, Mich., May, 1942

very helpful suggestions. By the end of the first season the one experimental outfit operated by a three-man crew had painted 26 sets of buildings. Two coats of paint had been applied over 260,000 square feet of surface area. From this trial we learned that the secret of successful spray painting was good equipment, operated by adequately trained men whose chief incentive was quality and not quantity.

We are now operating 12 spray paint outfits in three states. Each outfit includes a two-ton truck with a box body. This body is large enough to hold several hundred gallons of paint, supplies, and ladders, as well as four bunks for the crew members. A small, two-wheeled trailer carries the air-compressing equipment. Each crew has four men, two of which are gun operators and two are helpers. Three years of spray painting work have been completed with this equipment. Each year as the men have gained more experience, their wages have been increased. These higher labor costs have not made for greater total costs, however. Instead, production has increased more rapidly than wages and our total cost per square foot has gone down each succeeding year.

After painting more than 1500 sets of farm buildings with spray equipment, we are thoroughly sold on the merit of the method. The quality of the resulting job is fully equal to and in many cases better than a brush job. Spraying is fast, thorough, and economical. A four-man crew using a two-gun outfit can apply two coats of paint on the average set of farm buildings (10,000 sq. ft. of surface area) in two and one-half 8-hr. days. It would take a brush crew of four men at least ten days to do the same job.

Siding boards are usually cracked, checked, porous, and covered with dust. When paint is applied with a brush over such a surface, it bridges over most of these small crevices. As the paint film weathers it either cracks or wears away over the crevices first. Water, dirt, and moulds get into these unprotected places causing deterioration. When paint is sprayed on, it is driven into all but the smallest of these crevices giving much more thorough coverage regardless of the contour of the surface.

Spray guns made for commercial use have an adjustment by which the flow of paint through the nozzle can be controlled. By governing the flow of paint and the speed at which the gun is moved across the surface, the thickness of the resulting paint film can be controlled. This makes for better uniformity, quality, and economy.

The quality and type of paint

used are important in either brush or spray application. In order to obtain the optimum film thickness (0.005 in.) and eliminate loss of vehicle by excessive penetration, the paint should be designed to set up before too much of the oil soaks away from the pigment into the wood. First-coat sealers and primers put out by most manufacturers seal the surface and leave a good base for the second coat. Second-coat paints (particularly the whites) are usually slower drying and leave a flexible film which will chalk as it wears. Many red barn paints are now made to dry rapidly and to chalk slowly so that the same kind of paint can be used for both first and second coats. Both types of paint give satisfactory results.

In the Middle West the majority of farm buildings are not painted more than once in ten years. This is another reason why quality is important. The chalking type which contains a good proportion of pigment by volume has been found to be the most durable. A good way to determine quality is to check the ratio between the pigment and the non-volatile vehicle by volume.

When comparing costs of various methods of paint application, it is necessary to have a common denominator. Materials will run about the same for either brush or spray work. The labor cost has been considered to include the actual wages paid for man labor, social security, workman's compensation, unemployment assessments, and other payroll taxes, as well as a fair charge of upkeep and depreciation on equipment, operating supplies, and travel costs. No supervision, profits, or overhead charges have been included. These last three items are about the same for either the brush or spray method of application. Using this breakdown for arriving at costs, we have found that spray paint labor costs fifty per cent less than brush labor. Some writers have claimed a greater spread which is entirely possible. The amount of saving will depend largely upon the condition of the surface painted, the type of buildings, and the established wage rates within the given area.

In view of the advantages of spray painting, one wonders why it has not been more widely used. Certainly with some 60 to 75 per cent of the farm buildings in the country needing paint there is a definite field for a faster and more economical method. The benefits and savings of spray painting should be made available to the individual farmer. The plan that was used successfully in Knox County, Indiana, by Mr. H. S. Benson, county agent, could well be followed in other areas to introduce the

method and get it started. By canvassing farm communities for jobs, rural paint contractors should be able to get enough work to keep several spray outfits busy for years. Certainly there is enough farm painting work to be done and the money to do it if the labor cost can be assured at a reasonable figure.

DISCUSSION BY H. S. BENSON
County agricultural agent, Knox County, Indiana

In the past painting upkeep has been neglected by farmers because of circumstances over which they have no control. The cost of painting by professional painters has been prohibitive and the price of farm commodities so low that the farmer's only recourse has been to do the work himself or with the aid of his farm help. Because of these things we found the farm buildings in Knox County (Indiana) were being neglected as our farmers were unable to get to the off-season job of painting, and since the work was little understood and not attractive, it was neglected.

Paint-up and clean-up campaigns having been popular in urban communities and the officers of our Farm Bureau knowing of these campaigns, it was decided to put on one of their own by organizing a yard and garden contest which, of course, involved the improvement of farm buildings. When the question was asked, "How are we going to paint-up when the high cost of materials and high labor wage of professional painters and low income caused by low prices of our commodities are so great that they are practically prohibitive?" the officers of the Knox County Farm Bureau sought to solve the problem by turning to modern business methods as employed by the automobile, furniture, and other industries in spray painting. They immediately found that equipment for spray painting was expensive. Then they took a lesson from the extension service which had organized orchard spray rings in many communities. They organized the Knox County Paint Spray Ring to aid in this yard and garden contest.

The purpose of this paint spray ring was to cooperate in the purchasing of paint, in securing a machine, and in employing labor to apply the paint. It offered many advantages in speed, cleanliness, economy of time, labor, ease of operation, excellence and variety of work, adaptability, and reduced the cost 50 per cent and the time of application 200 per cent. That gave the farm home owner the same opportunity had by those in the towns. Over the period since its organization in 1930 the ring has painted the property of a large number of its

members and has made the value of its farm buildings greater and more permanent. The members of the Knox County Farm Bureau have always realized that paint will cut down depreciation of their buildings to a minimum, lower their overhead, and ultimately result in lower upkeep cost.

Paint manufacturers were asked to submit prices on paints of known quality. Ten manufacturers submitted prices. The successful company gave a low price on quality paint and furnished the compressor and engine for the painting. They also furnished an expert salesman to sell the paint to the membership, to aid them in selecting their colors and kinds of paint best suited to their needs, and to make collections for the paint.

When the paint ring was organized, a life membership fee of $2.50 was made, and this amount was used for the purchase of ladders, hose, and guns. The outfit consists of a 2½-h.p. engine and air compressor mounted on the chassis of a Model T Ford car which makes a four-wheeled trailer on which it is moved from farm to farm.

One hundred feet of air hose and one hundred feet of paint hose are connected to the 10-gal. paint container. In this container is set a 5-gal. bucket of paint. By the use of the full length of the air and paint hose a work radius of 200 ft. from the machine is obtained. The machine is operated under a pressure of about 35 to 40 lb. This pressure varies slightly, depending upon the height of the machine from the paint container.

The spray painting outfit was turned over to the Knox County Farm Bureau Cooperative Association in the spring of 1941, and they report that 23 farmers have used approximately 950 gallons of paint in 540 work hours.

The success of spray painting depends upon the operator. The painter will cover approximately 800 sq.ft. per hour, or based on a one-coat job, a coverage of 228.6 sq. ft. per gallon. If the operator knows farm people and appreciates their wants, there will be very few complaints. With proper protection very little paint will be wasted, and very little will get on other parts of the buildings and equipment, which is so aggravating to the average housewife and property owner. Our experience in Knox County leads us to recommend this plan very highly. We would recommend it one hundred per cent for farm homes, barns, garages, silos, granaries, corncribs, and other outbuildings. Also for automobiles, trucks, wagons, and farm machinery, and for porch and lawn furniture, or any other place it can be used in the open.

New Slant for Irrigation

Condensed from Kansas Farmer

Roy Croft, of Hodgeman county, Kansas, has proved that irrigation can be practiced successfully on hillsides, as well as on level lowland fields. Mr. Croft, one of the leading farmers and stock raisers in that area, irrigates 215 acres. Of this amount, 40 acres is a hilly field now being irrigated for production of pasture.

His hillside irrigation is made possible by leveled strips of land and dikes following the contour at different elevations on the hillside. The surveying and leveling was all done by Mr. Croft, with the assistance of hired labor. He admits it required a lot of work, but he says it is definitely worth the trouble.

In the summer of 1939, a 6-acre hillside, under irrigation, produced enough Sudan grass pasture to carry 5 milk cows, 5 horses and 40 ewes, from July 1 until frost. At the same time, 200 acres of native pasture on good, bottom land, not irrigated, carried only 1 ewe to the acre and it was necessary to start feeding 5 or 6 weeks before the pasturing season was over.

Mr. Croft obtains his water from several different sources. Part of it comes from his shallow well irrigation plant and some of it is pumped from a creek. Additional water is captured in the form of run-off, to be routed by way of terraces and ditches to a leveled irrigation plot.

Since his first irrigation venture, in 1934, Mr. Croft has never doubted the value of irrigation. He reports that in all the years since that time, his irrigated land has never failed to return a profit, while the land devoted to dry land farming has been a "hit and miss" proposition. "Taxes and other expenses continue, regardless of whether a crop is raised, so it pays to insure that a crop will be produced," he declares.

In 1939, despite drouth and grasshoppers, Mr. Croft's irrigated wheat averaged 24 bushels to the acre. His wheat on summer-fallowed land, not irrigated, yielded only 4 bushels. Mr. Croft's Wheatland milo under irrigation yielded 50 bushels to the acre, while forage sorghums averaged 25 bushels of grain in addition to the silage.

With 7,000 to 8,000 acres of land under irrigation in Hodgeman county, farmers there have developed a system of agriculture that is dependable every year.

Reprinted by permission from the Kansas Farmer, July 18, 1942

Just as Mr. Croft uses his irrigation to support a profitable lamb producing program, other farmers along the Pawnee Valley in that area are using irrigation to produce feed and pasture for other kinds of livestock.

Most of these farmers obtain double use of irrigated wheat. They utilize it as pasture during the winter and early spring; then they harvest a grain crop from it to realize an immediate cash income.

Storing Cabbage

The best way I know of storing cabbage is to wrap each head separately in newspaper. The cabbage should not be stored too early, for cabbage stands frost well, though a good solid freeze affects both the keeping qualities and flavor. This vegetable will not deteriorate if left in the ground or stored in a pile out of doors until really cold weather. It is an easy matter to save a pile of newspapers, and when it is time for storage, a short job to wrap the heads. A hundred or more crisp, hard cabbages go a long way to balance the winter ration for the farm family. This way of storing has been tried out on this farm for some years and is no longer an experiment but good management.

Cabbage keeps very nearly perfect when cared for in this way, simply stored in a cool place in the cellar. No bin is necessary, for they keep as well just wrapped and piled on the floor. Then, too, there is almost no odor noticeable, and if one head does spoil for any reason it does not affect the rest. Being wrapped, it is very easily disposed of. It has been found practicable to wrap the soft heads of cabbage and so keep them for green food for the flock of hens. A cabbage a day is a good green food ration for a small flock. This last year we fed the soft heads all Winter and clear into the month of April, and they helped materially to keep the flock laying. No other green food that I know is easier to furnish or better for the health of the hens. Even though storage space may be limited, still this plan works out well, for this way takes comparatively little space.

—*North Country Farmer*

Record of Performance for Swine

Condensed from Hog Breeder

Prof. A. L. Anderson
Ames, Iowa

SWINE raisers have been slow in developing and using performance tests that could be made useful in swine improvement. Dairyman have advantageously used the milk scale and the Babcock test to pick out their more productive cows. This then forms the basis for selective breeding. In the same manner the poultrymen have used egg laying ability to segregate the more productive. Meat animal producers have not had such tangible measures of performance to use in developing a selective breeding program.

Hog producers have made progress, especially along the lines of increasing the productive capacity of our brood sows without using very accurate means of testing. For example, in the matter of litter size the average size raised has been increased quite regularly from the time when such estimates were first made by the U. S. Department of Agriculture. The average litter size raised from the three year period 1924 to 1926 — was 5.56 pigs, while for the three years, 1939 to 1941, 6.26 pigs were raised per litter. These unweighted averages were obtained by pooling together the spring and fall estimates for the three year period. If we inquire into the reasons for such increase there probably would be a variety of answers. In all probability this improvement is due to several causes. Feeding and management has been improved. Also there has been an improvement in the equipment available for handling of sows and their pigs on farms. It would seem that improvement in breeding should be credited with some of the increase. In other words, our brood sows are probably farrowing stronger pigs and raising more of them because they are a selected sample as compared with their ancestors. Credit must also be given for the discovery of some control measures for some of the common diseases of suckling pigs. No doubt the knowledge of how to control suckling pig anemia has cut down materially the deaths among pigs. Further the "baby pig disease" now being in-

Reprinted by permission from the Hog Breeder, Chicago, Illinois, August, 1942

vestigated and its control is reducing pig losses. These are but two instances.

Even though we grant that our brood sows today are more productive measured by the size of the litters raised, there is still room for improvement. Good litter size raised is but one of the attributes of a useful sow. Some of the more difficult measures which might be applied to different samples of hogs are such qualities as, rapidity of gains, economy of the conversion of feed into gains, and carcass value.

History reveals that in Denmark the record of performance served a very useful role. Years ago when they lost their export trade for finished hogs to Germany, they set about to capture the English market. This they did, but only by supplying that market with what was wanted. In so doing it was necessary to standardize the Danish hog raising and to make it more efficient. Their record of performance testing identified the better strains, both in economy of gain and carcass value. By testing the Danes were able to improve markedly the efficiency of hogs in the country and the acceptability of their pork on the English market. In 20 years of testing the amount of concentrate of feed necessary to produce 100 pounds of live hog gains has lowered from 400 pounds to approximately 320 pounds. We in this country have a much more diverse pork demand to meet, but we still have too many inferior hogs marketed.

In a record of performance test at the Iowa Agricultural Experiment Station on 4 pigs from 44 purebred and crossbred litters marked differences were shown. In this test the 4 pigs from each litter were fed out together under controlled conditions and comparable with all other litters. The pigs were started on the test soon after weaning and they were fed out to a final weight of 225 pounds. Following is a tabulation of difference between the best and poorest on a litter basis:

With this sample the difference is quite startling. The best litters gained more than a half a pound per day, required 110 less concentrates for 100 pounds of gain and they were worth $1.74 more per hundred pounds on the mar-

	Best Performing Litter	Poorest Performing Litter	Difference
Average Daily Gain Per Pig Daily, Pounds..	1.68	1.13	.55
Total Feed Consumed Per 100 Pounds Gain, Pounds	468	358	110
Value of Carcass Per 100 Pounds Liveweight	$12.46	$10.72	$1.74

ket, considering the cut-out value.

This test referred to was quite complete for the feeding period and it is indicative of other disparities which may be more easily measured. Most testing of sows is on the litter size and the weight of the pigs at some age before or at weaning time. For purebreds' testing, fostered by register associations, some organizations use a 35 day weight while others are using 56 and 60 day weight. In all instances a range in the day of weighing is permitted and this then is corrected to the standard age.

Litters that are heavy at weaning usually retain their weight advantage throughout the weight gaining period. Therefore, weighing before weaning is used, since it is more convenient than weighing at a later date and it is also quite indicative of litter performance. It has also been demonstrated that rapid gains are usually more economical than gains made at a slower rate. There is also some evidence that lots of pigs making the most rapid gains are above the average in dressing percentage and carcass quality. Observations that can be rather easily obtained as litter size and litter weight are most expressive of a sow's productive ability and gaining ability of the pigs, and to some extent the economy of gain and carcass value. Sow testing is a forward step in breed improvement, since its broad purpose is the identification of superior producers.

What are the advantages of a planned test of performance or record of merit for swine producers? It would seem that definite progress could be made toward the accomplishment for the following objectives:

Superior breeding stock will be uncovered which will be kept in the breeding herd. Boars and gilts from superior strains will be in demand because they will be more productive than the average now used in our herds.

Inferior breeding stock can be weeded out promptly, such as is now done with low producing cows in dairy herds.

Superior breeding stock will raise more pigs that are heavies than less productive untested stock; therefore, fewer sows will have to be kept in the breeding herds.

Fast growing pigs are desirable in commercial hog production, since they have a shorter feeding period and usually are of higher efficiency in converting feeds into gains.

Not only will better hogs be uncovered by sow testing, but better methods will also be discovered as well as the better hog men.

Grass Varieties to Improve Western Range

Condensed from Seed World

Wesley Keller

U. S. Bureau of Plant Industry

GRASS is one of the great natural resources with which this country was originally richly endowed. It played a leading role in the history of the West during settlement and is as important today as at any time in the past.

A grass improvement program to serve the Intermountain Area was begun in 1936 by the U. S. Department of Agriculture, in cooperation with the Utah Agricultural Experiment Station and the Intermountain Forest and Range Experiment Station. The objective of this program is the discovery or development of superior strains of grasses for use in the maintenance and strengthening of the various systems of permanent agriculture. That use may be in irrigated pastures on highly productive land, on marginal farm land, on abandoned dry-farm land or the widely varying conditions of the foothill and mountain ranges. Perhaps the most urgent need relates to the restoration of grass on range and abandoned dry-farm lands, areas where acute feed shortages are encountered, and where, without the protective influence of grass, the lands are most susceptible to ruin by erosion.

The abandoned dry-farm lands and adjacent spring-fall ranges are subject to low rainfall and periods of prolonged summer drought. This zone is dominated by the Wheatgrasses (*Agropyrons*), and it is here that Crested Wheatgrass (*A. cristatum*) is of greatest value. At higher elevations, where moisture is more plentiful and droughts are of shorter duration, the Brome grasses (*Bromus*) are of great importance. There is of course some overlapping, for example, smooth Brome grass (*B. inermis*) makes a good showing on the more favorable parts of the Wheatgrass zone, while Slender Wheatgrass (*A. pauciflorum*), less drought resistant than smooth Brome, is perhaps more important at high than at low elevations. Numerous other species of grasses are of more or less importance in restricted areas.

During the first two years that

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the grass improvement program was in operation (1936-37) a large number of species of grasses were grown and their characteristics and breeding behavior noted, but by 1938, active attention had been restricted chiefly to four species, Crested, Slender and Bluestem Wheatgrass and smooth Brome grass. Each of these species differs from the others in one or more important characteristics which influences the manner in which its improvement is attempted. For example, Crested and Slender Wheat are bunchgrasses, but the latter is predominantly self fertilized. Bluestem and smooth Brome are cross fertilized, but these species are "spreaders." This greatly complicates the evaluation of single plants. Smooth Brome spreads relatively slowly and individual plants vary greatly in tendency to spread. Spreading plants soon become sod-bound and are never as productive, per unit of area covered, as are non-spreaders. Bluestem is a rapid spreader, but here again individual plants vary greatly. This species does not appear to become sod-bound as quickly, or to as great an extent, as does smooth Brome.

Among the cross fertilized grasses, once the desired plants are identified, the simplest method of improvement consists in restricting the fertilization of the selected plants to pollen from within the group. The progeny of this selected group will not all resemble the parent plants, but the parental type should be more abundant than in the original population. Further concentration of the desired characteristics will result from repeated selections in subsequent generations. This method, known as "mass selection," has been an important means of improving many species of cultivated plants. It is playing an important part in grass improvement today, and is expected to contribute many valuable strains. Several other methods, somewhat more complicated than mass selection, are also being employed.

In general, grass breeding is complicated by the necessity of including animals in the evaluation of selections. There is no satisfactory substitute for grazing. Another complicating factor is that, owing to seasonal influences, no single season is likely to provide an accurate estimate of a plant's yielding capacity over a number of years. Studies with smooth Brome have shown that the first reproductive season is especially unreliable as an indicator of the total yield of a plant for the first three reproductive seasons. Preliminary studies also indicate that different sources of smooth Brome show marked differences in vigor.

These different sources are actually strains (though unnamed, and unidentified as such) which have become differentiated through the selective action of their environments.

In the program in progress at Logan, Utah, promising selections are being rapidly increased for practical, large scale tests in order to determine their value more accurately. Inbreeding, hybridization, vegetative propagation and other techniques are being employed. A wide range of source material is being examined. Owing to the integrated action of grass improvement programs being conducted in each of the major agricultural areas of the country, grass and the problems related to its improvement are receiving the attention which it, as a crop of primary agricultural value, rightly deserves.

Cow Psychologist

To get the most from a dairy herd, a fellow needs to be a combination of cow psychologist, efficiency expert and man-on-the-jump, according to C. F. Huffman, peppery, pint-size dairy nutrition authority at Michigan State College. He points out that a hormone released by a gland at the base of the cow's brain travels in the blood stream to the udder and stimulates the milk glands to make the cow give down her milk. The stimulus is of short duration, and if a man isn't on the job to get the milk then, he never gets it. Cows get the habit of giving down milk at a regular signal, like the rattling of a feed cart, the start of a milking machine or the first mouthful of grain. So the signal must not be given too early and the work must be planned and carried out with enough speed so too much time will not elapse between the release of the hormone and the finish of milking.

Other Huffman tips: Space milkings 12 hours apart; move the cow whose teats leak forward in the schedule; keep strange dogs out of the barn at milking time, for the involuntary reaction they cause can keep a cow from giving down her milk.

—*Capper's Farmer*

All Out Production from the Pullets

Condensed from The Southern Planter

Dr. Morley A. Jull
University of Maryland

THE number of eggs your flock will produce during the next laying year will depend largely on the kind of house in which they are kept, the kind of diets fed, and the management of the flock.

The real purpose of housing pullets is to maintain egg production at a high level throughout the year. In extremely hot weather, the pullets are very apt to suffer considerably if they cannot secure relief in a cool house. The chicken has no sweat glands to assist in keeping the body cool, panting being the only means of relief against an excessive rise in body temperature during hot spells. In extremely cold weather, chickens not only suffer from the cold in a poorly built house, but in addition too much of the energy contained in the feed consumed is used to conserve body heat instead of being used for egg production.

A poor house may lower the egg production of a flock by as much as two dozen eggs per bird during the year.

For a flock of 25, 50 and 125 birds houses should have about 100, 180 and 400 square feet of floor space. Flocks of several hundred or a few thousand birds should be divided into units of about 125 birds, several units being housed in separate pens in a long continuous single story or double story house. The demand for increased egg production in the "win - the - war" program tempts many flock owners to overcrowd the houses. This is dangerous because overcrowding tends to increase cannibalism and mortality, and to reduce egg production per bird.

For most farm flocks, laying houses should be at least 16 feet deep and better still, 20 to 24 feet deep. One of the most effective ways of providing a comfortable house is to have it insulated, especially the roof. A well insulated roof tends to keep the house cooler in summer and warmer in winter. Insulation board is probably the best material for insulating the roof on a shed-roof type house. A gable and combination type roof can be insulated very effectively by a

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straw-filled loft supported by one-half or one-inch netting.

The best time to house pullets is about one month before they are ready to commence laying. Pullets differing over a month or so in age should be housed separately, if possible. Leghorn pullets should commence to lay at about 160 to 180 days of age, and general-purpose (Barred Rock, Rhode Island Red, etc.) pullets at about 170 to 190 days of age. At housing time, Leghorn pullets should weigh about 3 pounds each, about 3½ pounds by the time they commence laying, and about 4 pounds by midwinter. General-purpose pullets should weigh about 4½ pounds at housing time, about 5 pounds by the time they commence laying, and about 6 pounds by midwinter.

Too many farmers and commercial poultrymen make the mistake of housing practically all of the pullets that are raised. Nearly every flock contains some cull pullets that would never lay enough eggs to pay for the cost of feed, to say nothing of the other costs involved in egg production. Every flock owner should realize that every poor pullet housed lowers the chances of the flock producing eggs efficiently.

It is safe to say that among most flocks of pullets raised about 10 per cent should be culled to advantage at housing time. Flock owners would save feed and labor by culling from the flock all undersized, poorly developed, and sickly birds. Remember that feed costs money, whether you grow your own feed or buy it. Feed costs represent about half of the total costs of producing eggs.

Keep in mind that laying hens are very sensitive to sudden changes in feeding and management. If they are well fed and properly managed for six days, but neglected on the seventh day, the results in egg production will probably be reflected in the one day's neglect. When pullets are moved from the range to the laying house they should be fed fresh green feed for about two weeks, because green feed tends to be laxative and helps to keep the pullets in good physical condition. Sometimes when pullets are placed in the laying house feed consumption declines. To avoid this possibility, some flock owners feed a mash moistened to a crumbly state with skim milk at the rate of 3 pounds per 100 birds. Such a mixture tends to stimulate the appetite, increase feed consumption, and prevent loss in body weight.

Never allow mash hoppers to become empty. Stir the mash every day to increase consumption and add fresh mash every few days. The vitamin A and D con-

tent of mashes tends to deteriorate when mashes are exposed in warm weather. For each 100 layers there should be about 15 linear feet of hopper space. Keep an abundant supply of clean, fresh water available at all times. The daily requirements of 100 layers amounts to about 6 gallons, allowing for some wastage. Keep the litter dry at all times. Some poultrymen add fresh litter every week or so.

The scratch mixture is usually fed in the litter in such proportions that the layers eat about as much mash every day as they are fed the scratch mixture.

The use of artificial lighting on the basis of giving the birds a 14-hour day will stimulate fall and winter production when prices are relatively high. Commence lighting about the first of September, turning the lights on early enough in the morning so that the birds will have 14 hours of artificial light and daylight up to dusk. That is the simplest way of providing the birds with a larger working day and for the most part will not encounter any difficulty from "blackouts" in the defense program. In the spring the amount of artificial lighting should be reduced gradually.

The higher the level of egg production, the greater the feed consumption. The following figures give the daily requirements of 100 layers according to the number of eggs produced per 100 birds per day.

Number of eggs laid daily per 100 hens	Pounds of feed consumed daily for each 100 hens	
	Leghorns	General-purpose
20	18	23
30	20	24½
40	21½	26
50	23	27½
60	24½	29
70	25½	30½
80	27	32

Remember that when hens are in heavy lay, body weight must be maintained or the birds may undergo a partial molt. A little moistened mash fed daily will help to prevent this. With good stock given proper care, there is no reason why every flock owner should not make a reasonable profit in egg production during the coming laying year.

Plane Fish-Planting

Condensed from Flying and Popular Aviation

Richard Martin

ONLY a few years ago it was considered the height of angling luxury to fly fishermen to the lakes. Now they're flying the fish in, too.

As a result, hundreds of heretofore inaccessible mountain lakes are being stocked with fingerling trout, each lake destined to become an angling paradise within the next few years. The airplane is doing the job. Aerial fish planting is no new wrinkle in the age-old history of fishing, but it's new enough in this country (its birthplace) to have passed the experimental stage.

With the passage of years the supply of "good" fishing lakes has been decreased by taking more fish out of them than can be put back. Restocking has slowed but not halted this drain. Sportsmen have been forced to travel deeper and deeper into the wilderness in search of virgin fishing spots. Thousands of high mountain lakes offer ideal potential fishing—but they don't have in their waters any native trout or other game fish. Stocking them meant carrying fingerlings over difficult mountain terrain on mule-back. Aeration of carrying tanks under these conditions was impossible.

The airplane proved the solution, and many lakes were the scene of successful experimental fish-planting by air. State game departments and sportsmen's clubs cooperated in devising methods. First they tried dropping fish in containers supported by parachutes. The necessary equipment and the limited number of fish that could be handled proved too costly. Crowding them in the containers made aeration difficult. Considerable shock resulted when the containers hit the water.

Attempting to minimize this shock, experimenters devised a cylindrical container pointed at the bottom so it would penetrate the water. By this way both water and fish were drawn out the open end by suction during the drop. Examination of the lake waters where the cylinders fell disclosed no dead fish and the idea of dumping fish from a plane free was born.

In October, 1938, members of the Montana Fish and Game Commission rowed out on a small lake near the Billings airport. Herman Hendrickson, sportsman pilot and fishing enthusiast, loaded a can of fish in his plane, flew over the lake at

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altitudes of 100 to 400 feet and ladled out the fish and water with a dipper. The water was shredded into mist by the propeller blast and the tiny trout went squirming downward, splashing into the lake. Observers in boats saw the fish swim away immediately after striking the water. Fluttering and squirming in the air had cushioned their fall to the extent the fish weren't even stunned.

Heartened by this success, members of the Billings Rod and Gun Club decided to stock some of the inaccessible lakes in the rugged Beartooth Mountains. John Schofield, Montana superintendent of fisheries, decided that 5,000 California Golden trout, a native high-altitude fish, could stand the rigors of life at 10,000 and 11,000 feet. They were furnished by the state hatchery at Big Timber, along with 5,000 Albinos and 5,000 Rainbows.

A Stearman biplane was fitted out as a "fish tank." A 50-gallon tank was built into the front cockpit. A manually-operated dump valve six inches in diameter was fitted in the bottom, with its operating control placed in the pilot's cockpit. Spilling of fish and water in rough air was prevented by a hinged metal cover. Aeration of the water was accomplished by means of a half-inch copper tube leading to the tank from a funnel mounted on a strut. Thus the water was kept well activated by air under pressure.

The first large-scale stocking was accomplished without a hitch and, in July of 1939, the Federal Department of Public Works, Division of Aeronautics, published a report on similar operations carried out in the Stanley Basin region of Sawtooth National Forest.

Exhaustive tests revealed the mortality rate of the fish by aerial planting was less than one per cent. The report said "as the fingerlings are perfectly streamlined and light in weight, they reach their terminal velocity very quickly. They always met the water head foremost."

The trout were dropped from varying altitudes, the maximum being 500 feet, with a minimum water depth of three feet. Length of drop seemed to have no increasing effect on the mortality rate. Twelve lakes were serviced in the Idaho tests. Each flight took approximately 20 minutes and 6,200 fingerlings were dropped each trip, 75,000 in all.

Total cost for rental on the plane, tanks, labor and time was $249.77. Cost per fish planted was 3 and 3/100 mills. It since has been reduced materially. The Federal report drew the conclusions that for future operations of this type it would be desirable to

use a plane with a payload of from 800 to 1,000 pounds, making possible the installation of three or four separate tanks, each having its own dump valve and aerating pump. Thus the aircraft could serve three or four lakes on one trip.

The plane should be capable of operating at altitudes up to 15,000 feet, and from 1,200-foot runways with a full pay-load. It should have a stalling speed not in excess of 60 m.p.h. and should be highly maneuverable at low speeds.

Since these initial experiments, the stocking of high altitude lakes by plane has spread until it is a vital factor in conservation from Canada to Mexico. Eventually it may reach the point in economy and speed to where it will be found practical for stocking all lakes, whether accessible by surface means or not.

Lime Becomes Part of Soil

Five years may be necessary for an application of ordinary 10-mesh limestone to reach its full chemical effect on the soil, says W. A. Albrecht of the University of Missouri College of Agriculture. Good effects will be realized within one year and these benefits will increase as the calcium becomes a part of the soil, reaching their maximum possibly in five years and then gradually declining unless more lime is applied.

Experiments show that liming the soil does not change the plant food content of the soil immediately. The soil requires time for taking up the lime and becoming more highly saturated by calcium. Lime applied in 1930 had not loaded the soil to the maximum calcium saturation effect until 1935. By 1937 this calcium saturation effect had begun to drop and the soil was again losing its calcium. This happened under a rotation of corn, wheat and clover - timothy, and under alfalfa grown continuously.

These results, revealing the increasing calcium saturation of the soil with time as the lime combines with it, mean that lime, to be effective, has to become a chemical part of the soil. The lime in this soil form is rendering better service to the plants than in the form of lime rock fragments merely mixed mechanically through the soil.

If an application of limestone keeps on increasing the calcium saturation of the soil complex for five years before the saturation begins to decline, there is the suggestion that a heavy lime application once in 4 or 5 years is often enough.

—*Missouri Farm News*

The "Trask" Plan

Condensed from Turkey World

M. C. Small
Managing Editor

WHEN A. H. Trask and his brother moved from Iowa to a small southwestern Wisconsin town in 1927, the produce business was at its height. They bought out a produce concern and did a fine business. After a time, however, the trucking business increased, and gradually cut into the buying of produce at country points. As time went on, it appeared inevitable that something else must be done to supplement their income.

The Trasks conceived the idea that turkeys might be grown on a *contract plan*, much in the same manner as was being used for growing tomatoes, peas, etc. They summarized their figures and devised a plan which would give the grower a chance to make some money, yet would make him take a personal interest in caring for the turkeys.

The plan that resulted is so simple that practically all chance of misunderstanding is eliminated. Trasks furnish the brooder houses, poults, equipment, feed and, in fact, practically everything but the land and labor. Each grower is given from 4,500 to 6,500 poults. Raising the poults is mainly the grower's responsibility, but A. H. Trask supervises them as closely as possible.

The growers are paid according to the percentage of poults grown. They are guaranteed 20 cents for each market bird produced, regardless of the mortality experienced. For each percent of the birds they raise over 75 percent, they receive an additional cent per bird.

For example, the grower who starts 6,000 birds and raises 5,100 (85 percent) would receive 30 cents per bird, or a total of $1,530 for raising the turkeys. Poults, houses, equipment and feed are all delivered at the farms, and market birds are picked up at the farm when mature. The grower is also reimbursed for any direct expenditure he might have in connection with his flock.

"Occasionally a man will experience a heavy poult loss early in the season," explained Trask. "If the loss is not due to gross

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negligence on his part, we usually readjust his contract to give him something for which to work."

About 30,000 turkeys are grown on contract farms at present.

Poults are provided for the farms by a model hatchery plant. Eggs have been procured by different methods ranging from keeping a breeding flock to buying all eggs. Trasks are not yet satisfied with their poult procurement methods and are still experimenting with various ideas to find which would be best.

As would be necessary for such a business, the houses, equipment and methods are fairly well standardized. Because the houses must be moved from farm to farm as necessary, they must be of colony type. The brooder houses are constructed of composition board. This has been found to be a satisfactory material, and some of the houses have been in use for eight years. Areas where the poults are likely to pick holes in the composition board are covered with sheet metal. Most of the houses are of shed roof type, but some of the last ones to be built are of a type which Trask describes as "hip-roofed."

Large sun porches are used. The floors of the first ones built were made of 1 by 2 in. welded wire. The last ones built are made of inch mesh fox wire which is a hexagonal netting made of 16 gauge wire. Trask has found it necessary to use strips of fox wire over the floors for the first few weeks in the porches having the 1 by 2 in. wire as several young poults have been lost from catching their hocks in the larger wire.

The first porches constructed are 12 by 16 ft. The sides are made of lath. The lower part is made of battery fronts that can be adjusted according to the size of the poults. This is accomplished by using a double wire front consisting of two sections of 2 by 12 in. mesh welded wire. The size of opening is regulated by sliding one section over the other, resulting in openings ranging in width from about 1 in. to 2 in. These sun porches have metal frames. Metal feeders are hung from the outside of the porches.

The new porches built this season are 12 by 24. They are somewhat similar to the others but have wooden frames and the sides are made of wire instead of lath.

On both types of porches outside roosts are provided, and the poults are encouraged to get outside as much as possible. Usually at about 4 or 5 weeks, depending on the weather, they are forced to stay outside, the house is cleaned thoroughly and a new brood started inside. The grow-

ing birds on the porches are protected by placing building paper or feed sacks across the tops of the porches.

Oil-burning brooders are used. The number of poults started per stove is quite large—about 350. However, with the methods they are using, they seem to get by satisfactorily.

Peat moss is used for litter. Waterproof crinkled paper is used over the litter at first. This is purchased in large rolls. Ordinarily, four layers are placed over the litter. After two days, the first layer is removed, and one layer is removed each following day.

The poult guard for each house is made of strips of sheet metal. These strips are fastened together in a circle around the stove. The strips are held together by spring-type clothes pins.

At about 8 or 9 weeks, the growing poults are moved to range. Range equipment is standardized also. Two types of shelters are used. The larger one, and the one Trasks like best, covers approximately 12 by 16 ft. The smaller shed roof type is 10 by 12 ft. Even though the soil in this section is sandy, growers move about each week on range.

Keep Alfalfa Bright Green To Preserve Protein

Seventy-five percent of the protein in alfalfa is in the leaves, and leaves with a bright green color have the highest feed value. Studies made by the Nebraska Experiment Station show that the best alfalfa hay can be made by getting the hay into the windrow before the leaves have become dry and brittle. The alfalfa should then be stacked before it is thoroughly dry, as some internal moisture in the hay will do no damage. Care should be taken, however, to see that the hay carries no external moisture from dew or rain. Such moisture will cause molding.

Where possible, large stacks should be made, since these have a lower percentage of spoilage on the tops and bottoms or on the sides. High round stacks with vertical sides and a nearly flat top have the lowest percentage of hay exposed to the weather or to damage on the ground.

—*Nebraska Farmer*

How the Army Controls Flies

Condensed from Pennsylvania Farmer

KNOWING that the fly carries diseases and that it may be the means of spreading infantile paralysis, army officials take stern measures to keep the fly population down. They have tackled the problem with a thoroughness which provides a lesson for the general public. The reason that they get more attention in the army than they do on the farm is that the army has learned the menace to mankind of the common house fly.

While army methods do not disdain to kill a fly at any age or condition, they concentrate on the most vulnerable period in the life of the beast, which is before it becomes a fly. The egg and the larva can be destroyed more easily than the mature insect. Wholesale destruction of flies starts at the beginning. The first step is to prevent their start in life, and that is done by making conditions unpleasant for the grown fly and fatal to it in the egg or larva stage.

Flies are attracted by smell, not by sight, so sanitary measures aim at preventing smells. This is done by eliminating wastes, for any waste material left to lie around and decompose is a source of odor and an invitation to flies. Under army regulations half-way measures are not sufficient. "No waste" means cleaning up and keeping spick. This sort of housekeeping over acres of land is the duty of an army's sanitary personnel.

Much of the waste around army camps is burned. Numerous incinerators have been developed to consume it completely. Arrangements are made for collecting and disposing of wastes found in water, such as dishwater. Army dishwater is strained, the fats and solids collected and burned, then the water run into the soil which absorbs it without harm.

The army has developed a number of kinds of fly traps. The best and simplest, built of wood and screen wire, is constructed on the principle of the pioneer turkey trap. Flies, like turkeys, look up when they try to escape. In this trap they are attracted by food to a bottom compartment, then following their natural instinct, they try to get out upward—and upward there is no exit, so the fly is a prisoner of war, and to him no quarter is shown.

Since flies are attracted by

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both food and light, fly traps should be put in light places. Food for bait may be milk, bread, molasses or corn meal and yeast. These things are irresistible to a fly. Any practical bait placed in the bottom of a trap will draw the flies in, and the instinct of the insect to soar will result in its capture.

On farms with water systems and septic tanks dishwater is no problem, for it goes down the drain, but wash water and water from butchering are often allowed to run out on the ground to the delight of flies and the danger to farm families. A grease pit to dispose of them can be cheaply made on the army pattern as follows:

A pit four feet square and four feet deep is dug in the ground and filled with broken stone. From the bottom of the pit up through the stones and a foot above their surface extend two air vents. They are made by nailing together four 4-inch boards to make a square pipe and the top is covered with screen wire. Over this pit is set a tub—half a barrel will do. It has a partition not quite reaching the bottom. The movable lid is hinged for easy access. In the lid is set a 12-inch square box, its bottom perforated by nail holes and the box itself filled with hay or straw.

The dirty water is poured into this hay-filled box. The hay catches the larger pieces of waste, the partition catches the grease and the water runs into the ground. A lid over the hay box will keep out the flies. When it gets clogged up the hay is removed and burned. The accumulated grease is scraped off when necessary. The water which seeps into the ground needs no further attention.

Since barnyards are the main breeding places for flies, the visiting farmers were much interested in seeing how the army manages a fly-less manure pile. Two huge compost piles were observed, each holding enough rotted manure to fertilize a farm —not too big a farm. Contrary to expectations, no swarm of flies erupted from the piles when observers approached them. The manure was practically free of flies and odor. It looked like an ordinary manure pile except it was built with straight lines, smooth sides and right angles—not on the streamlined style seen in farm barnyards. The sides appeared as if singed by fire.

In the blackened singed sides and top of the rectangular mass lies the secret of the army's fly-less manure pile, for each day as fresh manure is piled on it is sprayed with a fly repellant, making a "singed earth" land where flies' eggs will not hatch or maggots develop. Five different substances, all cheap, have been

found effective for this spray, says Lieut. R. E. Bender. They are medium grade fuel oil, pyrethrum, borax, iron sulphate and two per cent creosote. Hellebore is also effective for this purpose. They are applied with a hand sprayer. The army manure pile is kept square and shipshape, its top flat and its sides raked down and thrown on top occasionally. The result in appearance alone is worth something.

French peasants take great pride in their manure piles, not on account of their beauty or aroma, but because of their plant food value. If farmers in this country go in for the army's style they may point with pride to their manure piles from the standpoint of artistry as well as fertility.

Capt. Regan points out that in army circles a manure pile is more fancy than is necessary on a farm. It has as a foundation a slab of concrete perhaps 20 feet wide and 50 feet long. Around this is a concrete ditch a foot deep and a foot wide. The ditch is filled with crude oil. When a fly maggot tries to reach a warm home from without this reservation it finds itself confronted by a moat of oil, in which it meets its end.

The principle of a high and dry foundation and a maggot-proof barrier can be followed in a barnyard at less cost. It was suggested that a crushed stone and clay base would serve instead of concrete, but that it should be surrounded by a ditch in which oil will stand. Concrete is of course already used to pave many barnyards, and it is ideal for the purpose, but whether it or some other material is used, the principle to remember is elevation for dryness and a ditch for oil. Mud mixed with manure becomes a breeding-place for flies. Larvae will burrow in it and come out with wings ready to carry on their nefarious livelihood.

By building a manure pile in a neat and orderly manner a smaller surface of fresh manure is exposed each day. This requires less spray material and less time to apply it, and any harmful effects of the spray on the fertilizing value of the pile is minimized. The sprays recommended, it is believed, have practically no effect on the fertilizing value of the manure. But if a little plant food is lost from the surface of the pile credited against it should be the comfort of fewer flies and the satisfaction of more healthful surroundings.

A better method of fly control than a geometric and sanitary pile of manure, say army officials, is no manure pile at all. They recommend that if possible manure be hauled and spread on fields every day. But where this

cannot be done it is felt that the army method of management is worthy of consideration by farmers, who are entrusted with the task of feeding the nation and of guarding the health of their own families.

The army keeps no cows, but a permanent post has horses and hogs. The hogs are kept to consume garbage. The garbage is sorted and handled so there is no odor around the hog pens as is usual around a garbage feeding plant. The hogs themselves look healthy and comfortable, but their quarters would not appeal to a practical hog raiser. The farmer keeps hogs for pork. The army keeps them to consume waste. The different purposes explain the different ways of management. Army hogs, like battery poultry, never touch the ground. They live on concrete, without a shred of bedding. The concrete is washed clean with water. Around the pens and runways, which also are of concrete, is a no-man's-land for flies made by soaking the ground in a foot-wide strip with crude oil. This meets the same purpose as the oil ditch around the compost pile.

Hog sanitation is a science in itself, important for profit from porkers. A check on the way a farmer is following sanitary practices is for him to go out to the hog lot and count the flies. If he can do so he is all right, but if there are too many for his arithmetic he may want to indulge in a little campaign with the shovel and the hose.

Rape as Fall Pasture

Rape is seeded in corn at last cultivation for late pasture by Virgil M. Sheafor, Richland county, Wisconsin. Last year 22 dairy cows went into it as soon as the fodder from the field could be cured and shredded. Cows had their choice of rape or alfalfa and took part of their feed from each.

"One of rape's greatest advantages," Sheafor said, "is its hardiness to cold. In any year it can be grazed until snows covers it so deep cows cannot get at it. They will go thru 6 inches of snow to get it, and I have utilized it well into December. Many will not use rape for dairy cows because it taints milk. However, taint can be avoided by turning the herd out after they are milked and removing them two hours before the next milking. I do that, and there is no trace of rape taint in the milk."

—*Capper's Farmer*

Proving Beef Sires

Condensed from New England Homestead

A SIMPLE method of "proving" beef sires similar to the plan now used in "proving" dairy sires has been developed by beef cattle specialists of the U. S. Department of Agriculture. By this method young bulls may be proved by their first calves and their value as sires determined.

The two plans are alike in that the worth of the sire in both cases depends on his progeny's record-of-performance. The beef sire is judged on his ability to transmit a capacity for efficient gains and high-quality meat just as the dairy sire is rated on his ability to transmit capacity for high milk and butterfat production.

Beef-cattle breeders still depend largely on pedigrees and breed type in selecting herd sires, although differences in the ability of sires to transmit efficiency of gain and carcass quality to their progeny have long been recognized. Many sires of good type do not produce calves that gain efficiently.

Proving of beef sires has required study and evaluation of many factors affecting the calf from the time of birth until it is slaughtered.

The first essential in proving the beef sire is an equal opportunity for all of his calves on test—there should be a minimum of five steer calves. Because the dam of one calf may give more milk than another, the test is begun shortly after weaning time and the calves weaned at the same weight regardless of age. In the department's tests all calves were started on the test at 500 pounds and slaughtered at 900 pounds. Neither the time spent in gaining the 400 pounds, nor the age of the calf when the test began are considered.

In the department experiments each calf was fed in individual self-feeders so that an accurate check on the amount of feed consumed could be kept. Each was allowed to eat all it wanted so as to make full use of its ability to produce efficient gains and high-quality meat. Only calves from purebred dams of the same breed as the bull were used in the tests.

In the proposed method of proving beef sires, the fattening ration may vary from region to region, using the most practical and available feed. Corn, barley, wheat or grain sorghums may make up the bulk of the record-of-performance ration, with a dry

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legume roughage that is more or less uniform in quality from year to year. At the Agricultural Research Center, Beltsville, Md., the ration consisted of two parts of cracked corn to one part alfalfa hay.

In developing the method, 20 body measurements were made of each calf as they went on feed and again just before slaughter, but it was found that weight and height of the animal at the withers give a good correlation of all the measurements. From these two measurements, the grade of the steer may be determined. Using this method of evaluation, it is pointed out, a record of the worth of all beef sires would be available if kept by a central agency.

How the record-of-performance tests may eliminate some sires with blue ribbon ancestry was shown at one of the Bureau of Animal Industry's stations. Here, calves from two bulls of prize winning ancestry were placed on a corn and alfalfa ration—the corn valued at 60 cents a bushel and the alfalfa hay at $20 a ton. The cost of the 400 pounds gain for calves of one sire was $31.66 per calf less than for the other sire.

238 Pounds Mutton An Acre

If you have some good first-year sweet clover, don't overlook its possibilities. Frank Lamb and Walter A. Newlin, 50-50 farming partners in Clark county, Illinois, had 32 acres of soybeans. Lamb needed hay, so the field was divided and he put up 16 acres, while Newlin combined his half for beans. Sweet clover and timothy then were broadcast on top of the ground. The next year first-year clover got 4 feet high on the combined portion; 3 feet high on land from which hay was harvested. To utilize growth of timothy and clover, 280 wethers averaging 72 pounds went into the 32 acres August 8. When 272 of the sheep were sold November 6, they averaged exactly 100 pounds. The field had produced 238 pounds of mutton an acre in a period of 3 months.

—*Capper's Farmer*

Make Hogs Heavy for More Profit

Condensed from The Nation's Agriculture

True D. Morse
Doane Agricultural Service

THE common rule to sell hogs at 200 pounds should not be followed in the present situation when 300 and 400 pound hogs are selling at top prices or within 25c to 50c of top prices. The 200 pound rule is now neither good business nor patriotic.

Normal rules must often be discarded in abnormal times like the present. The farmer who is going serenely forward with his usual methods of farming may easily be missing much of the profits he should now be making and he may well take abnormally large losses when price adjustments come following the close of the war. Both of these pitfalls may be avoided in a measure at least by keeping alert to the rapidly changing price and other economic relationships.

Efficient hog producers who are sending light-weight hogs to market under present feed and hog price relationships are not making the most profit unless they have an unlimited supply of pigs in relation to feed yard capacity.

Even though hogs are fed to heavier weights, they should be marketed at or near the periods of the year when hog prices are normally highest. This will insure highest prices when the market again starts taking the normal seasonal fluctuations.

By feeding hogs to 300 pounds instead of selling at the usual 200 pounds, farmers can step up hog production by one-half, or 50 per cent, without increasing the number of sows and the investment in equipment. Even adding an extra 50 pounds to make 250 pound hogs gives a one-fourth or 25 per cent increase in production. This is an easy and profitable method of meeting the Government request for a 14 per cent increase in hog production for this year.

The week ending January 3, 160 to 220 pound hogs sold at the highest average daily price at Chicago. On the St. Louis market the highest prices were paid for hogs of 160 to 180 pounds.

The week ending May 23 the Chicago market paid highest prices for hogs weighing 200 to 240 pounds and on an average, only 2c per 100 pounds less for hogs weighing 240 to 300 pounds, $14.12 per hundred. The same

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week prices on the St. Louis market averaged the same for hogs of 180 to 270 pounds. Hogs 270 to 300 pounds sold at only 8c per 100 pounds less than the average for the lighter weights.

With 85c corn, hogs weighing 300 pounds can be produced at a cost of about $8.60 per 100 pounds. This leaves a margin of over $5.00 per 100 pounds, or $15.00 per 300 pound hog. This profit margin alone amounts to more than the total price for 200 pound hogs less than a year and a half ago.

If hogs are sold at 200 pounds instead of 300 pounds, the cost to produce them is lowered to about $7.55 per 100 pounds. The margin will then be about $6.00 per 100, or a total of $12.00 per 200 pound hog. The extra $3.00 per hog for 300 pound hogs as contrasted to hogs weighing 200 pounds is a nice addition to profits. It is $600.00 more per year on a 12 brood sow farm producing two litters of pigs per year.

Here are some representative sales from a Corn Belt farm where the management has departed from the usual 200 pound rule. Net hog profits on this farm will probably reach $25,000 for the year.

The exact weight at which to sell is dependent upon many factors, such as those which follow. They have varying importance, depending upon the conditions which prevail on a particular farm.

1. The price of corn is the most important factor in determining how heavy to make hogs for any market. As long as a ceiling is maintained on pork and demand holds hog prices up to that ceiling, farmers need primarily to watch the price of corn and supplemental feeds in comparison with the ceiling for pork prices.

Hogs should still be marketed at the period of the year when prices are normally highest in order to get any price increases that may develop.

2. When pork prices are not regulated there are both the seasonal and cyclical prices of hogs to be watched.

With fairly constant feed

Sales on a Corn Belt Farm

	Av. Weight Pounds	Price Cwt.	Market Top Price
March 1	306	$13.10	$13.35
March 17	291	13.30	13.40
April 1	257	13.75	13.75
April 8	250	14.45	14.50
April 14	290	14.30	14.35
April 15	268	14.40	14.45

prices, Iowa State College reached the conclusion that a rise of $1.00 per 100 pounds in the price of hogs made profitable the addition of about 20 pounds to the average market weight of hogs.

3. The thrift of the hogs and especially the rate at which they are gaining is very important. Skillful managers and feeders, unless they have extremely wide margins, such as at present, will be constantly detecting and sending to market the "slow gainers" and letting the "rapid gainers" stay in the feed lots until they reach a maximum weight for the market.

4. The number of feeder pigs available and the cost at which they can be had is another important factor. Obviously, if feeding facilities can be operated to capacity with a constant flow of hogs going to market at 200 pounds there would be no object in taking the penalty of the slower gains as the hogs exceed that weight.

Many farmers, however, do not have the extra pigs and if they undertake to buy them the excess cost by the time they are in the feedlot, vaccinated, and on full feed will often more than offset the slower gain secured by the continued feeding of the other hogs above the 200 pound weight.

5. Feeding equipment and the season of the year will be regulating factors in some cases. Lack of weather protection, especially from extreme heat in the summer, may make it important not to make the hogs too heavy. With other pigs coming on, the older hogs may need to be sent to market to make self-feeders and other equipment available.

6. Alternate use for the available feed may be a determining factor. Other livestock on the same farm might more profitably use the feed. This will usually not be the case because of the efficiency with which hogs produce meat.

7. Labor peaks may make it desirable to sell at an earlier date.

Hog feeders should not stop short of heavier weights because of the lack of feed on hand so long as corn can be purchased at prices that make feeding profitable. With the strong probability that feed prices will continue to advance, it is important that feeders of not only hogs, but other classes of livestock should fix the feed costs by purchase of needed feed at the time of starting a feeding operation.

Iowa State College recently made a study of how long it paid to feed hogs. They summarized the data on the hogs used on feeding experiments. The accompanying figures were the result and make valuable base figures to be used by farmers in de-

Table I. The Feeding Performance of the Experiment Pigs

Weight Interval	"Rapid Gainers" Average Daily Gain	"Rapid Gainers" Average Daily Feed	"Rapid Gainers" Lbs. Gain Per Lb. Feed	"Slow Gainers" Average Daily Gain	"Slow Gainers" Average Daily Feed	"Slow Gainers" Lbs. Gain Per Lb. Feed
40- 80	.80	2.85	.280	.80	2.90	.275
80-120	1.16	4.55	.255	1.20	4.80	.250
120-160	1.38	5.78	.238	1.45	6.00	.240
160-190	1.49	6.67	.223	1.55	7.00	.220
190-210	1.50	6.85	.219	1.45	6.90	.210
210-230	1.48	6.90	.214	1.35	6.90	.195
230-250	1.44	6.95	.207	1.25	6.70	.185
250-270	1.40	7.00	.200	1.20	6.70	.180
270-290	1.37	7.10	.193	1.20	6.85	.175
290-310	1.34	7.20	.186	1.15	7.20	.160

termining how heavy they should make their hogs under varying feed and price relationships.

Table I shows the constant decline in the pounds of gain per pound of feed consumed. Both this and the normally lower price for large hogs must be considered in deciding how heavy to make hogs before they go to market. The table shows that the "slow gainers" had a very good record up to 190 pounds but after that their gains fell off rapidly. This indicates that slow gainers should be detected and sent to market first where there is not a wide feeding margin. The data showed that the better gaining pigs should be fed to 20 pounds heavier at most prices.

Table II shows the price at which hogs would have to sell at different weights to break even, using corn at a cost of 1½c per pound.

Ohio State University found gains and feed requirements at different weights to be as follows:

Table II. Cost of Producing 100 Pounds Gain with Corn at 84 Cents per bu.

Weight Interval	Rapid Gainers	Slow Gainers
40- 80	$6.52	$6.63
80-120	6.92	7.04
120-160	7.21	7.13
160-190	7.49	7.59
190-210	7.55	7.87
210-230	7.65	8.32
230-250	7.85	8.67
250-270	8.05	8.98
270-290	8.30	9.12
290-310	8.55	9.90

Feed Consumed and Rate of Gain by Pigs of Different Weights

Weight of Pigs	Daily Gain (lbs.)	Lbs. Feed per 100 lbs. gain
Birth to 100 lbs.	0.81	304
100 to 200 lbs.	1.70	359
200 to 300 lbs.	1.83	415
300 to 400 lbs.	1.71	470
400 to 500 lbs.	1.58	510

As is always the case, the efficient producer of pork can increase the margin of profit over the average figures shown here. Likewise, the inefficient farmer and feeder must realize that he is working on narrower margins than average figures reflect. It is a simple matter for every farmer to secure actual cost figures on his hog production. A few simple records will show what gains he secures on an average and how much feed is consumed per 100 pounds of hogs marketed.

With rapidly rising costs and shortages, especially of labor, next year may be less profitable even though the price level is higher. Every farmer should, therefore, be doing everything possible to "cash in" on the present situation. Feed is expected to be much higher next year in comparison with livestock prices. Now is the time to feed hogs to heavy weights to secure extra profits and give the government the needed pork and lard supplies.

Grazing Habits of Cows

Condensed from Eastern States Cooperator

THE mystery is solved as to what a cow does with her twenty-four hours a day. The scientists have found answers to: What does she eat and how much? Does she get her eight hours of sleep? Does she graze during the night? Is she particular about how high the grass grows?

A cow will graze only about eight hours out of each twenty-four regardless of the luxuriousness of the pasture, it was found.

A graduate student, who is studying for an advanced degree at Cornell University under Prof. D. B. Johnston-Wallace, watched the grazing habits of cows for twenty-four hours, night and day, and recorded their behaviour in an excellent Kentucky blue grass and wild white clover pasture.

The cow, a beef cow, whose behaviour was most closely watched, was an Aberdeen-Angus. A dairy cow was not chosen because she gets grain in addition to pasture herbage; a beef cow does not.

By watching the cow's nose, Kennedy observed she preferred tender grass and clover herbage from four to five inches high. While grazing. she took from fifty to seventy bites a minute, but occasionally stepped the rate up to ninety. Out of the twenty-four hour day, she spent twelve hours lying down, eight hours in grazing, and four hours standing or walking around, perhaps looking for a hole in the fence.

She walked two and one-half miles in the twenty-four hours, most of it in the day time, but grazed as much during the night as during the day. She drank water only once, but the pasture herbage grazed had a high water content to make up for it. She suckled her calf three times for fifteen minutes each.

She consumed 150 pounds of grass and clover herbage containing thirty-two pounds of dry matter. This amount is equivalent to a heap about six feet in diameter and three feet high in the center. It is gathered with "mowing machine" jaws about two and one-half inches wide that can clip within one-half inch of the ground.

One of the things learned was that as grazing progresses and the herbage gets shorter, the amount consumed by a cow is reduced. After a few days she may be able to gather only fifty pounds a day. Other investiga-

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tions have shown that when herbage is allowed to grow taller than four to five inches and head out, the amount consumed in a day is also reduced, and the feeding value of the herbage decreases.

Only in good pastures can a cow consume the maximum of 150 pounds a day, it was learned. Such a pasture, the scientists say, contains about 3,000 pounds of green material to the acre while the stock are grazing.

Some of the improved pastures at Cornell University often produced more than 30,000 pounds of green herbage in a single grazing season, whereas unimproved pastures often produce less than 3,000 pounds. On the latter a cow probably never eats more than fifty pounds a day.

Based on these results, it is estimated that a dairy cow with enough good pasture to permit her to gather the 150 pounds of green herbage every day could produce about forty pounds of milk daily without losing weight.

The scientists admit, however, this would be difficult to achieve in practice, but that it can be approached with a system of alternate grazing. Under this system cows are allowed to graze each of four to six fields in rotation for a few days. After this, grazing is completed by dry cows, young stock, and horses. Then comes a rest period of a few weeks to permit the herbage to grow again to four or five inches.

And to prove that there's nothing new under the sun, maybe, this practice was first suggested by a friend of George Washington, Dr. James Anderson, of London, England, in a book written in 1798.

Milk Production Possibilities

Condensed from The Rural New-Yorker

R. W. Duck

Secretary of Agriculture Claude R. Wickard has stated: "Of all the farm commodities of which increases are needed the most urgent is for more milk. To reach the production goals for 1942 the greatest effort will be required in dairying."

It is no longer a question of shall we meet necessary quotas, but how we may best *do so*, and what is the quickest and most economical method of accomplishment. The National dairy production goal is estimated to be not less than 125 billion pounds of milk for 1942. On a comparative basis this is eight billion pounds increase over a corresponding period of 1941, and is an 18 billion pound increase for the average annual period of 1936-40.

Cow testing throughout the Nation, and particularly the excellent and comprehensive work conducted by Prof. W. T. Crandall at Cornell has clearly and repeatedly demonstrated that the most common production error is to under-feed potentially good producing cows and over-feed the poor producers. It is self-evident that to meet milk production goals for our 1942 quota it will be necessary to feed increased amounts of concentrates. The ratio of feed price to possible increased milk production, and the ratio of this increased feed production cost to the comparative total monetary return, is therefore pertinent to our problem.

One of the most striking and practical examples with which I am familiar is a test conducted at the Indiana Station several years ago by Professors L. H. Fairchild and J. W. Wilbur. Several good cows representing the different dairy breeds were purchased from farms where they had been underfed. In discussing this test with Dr. Fairchild on one of my visits to the Indiana Station, he mentioned the fact, which seems now to be especially applicable, that the owners of these cows gave as a reason for under feeding that feeds were too expensive. In the Purdue herd these cows were fed all the alfalfa hay and corn silage they would consume. Their concentrate feed was a mixture consisting of 4 parts ground corn, 2 parts ground oats, and 1 part linseed oilmeal. This was fed in the ratio of 1 pound of concentrates to each 4½ pounds of milk

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produced by the Holsteins, and 1 pound to each 3 pounds of milk produced by the Jersey and Guernsey cows. The average price received for milk was $2.30 per hundred for 3.5 percent milk with 4 cents differential per point up or down from 3.5 percent. Feed cost of these cows at Purdue was increased 65 percent over their comparative farm feed costs for their previous year's lactation. However, their average milk production was increased 71 percent, and this resulted in a 74 percent increase over their previous year's income.

Current tests at the Maryland and Pennsylvania Experiment Stations, relative to the law of diminishing returns for feed consumption and milk production, indicate a favorable ratio up to at least 1 to 3, and possibly even narrower depending on the price received for the product. We need to consider carefully the fact that it has been conclusively demonstrated that good cows will return a profit on all the feed they will consume. It seems this is especially applicable when they are fed roughage in the ratio of 1 pound of good quality hay and 3 pounds of silage for each 100 pounds bodyweight, or 2 pounds of hay alone. One pound of hay has an equivalent nutrient value of about 3 pounds of comparable quality corn silage.

A return of 101 percent was realized for the money invested in the increased feed cost of the Indiana cows mentioned. It is therefore concluded that many dairymen could receive a larger net income from slightly more than one-half of the cows they are now keeping if the good cows were more correctly and adequately fed, and if the poor producers were culled from the herd and sent to the butcher. Slaughter prices for cull cows in good plants are now very attractive.

An excellent test relative to the best amount of roughage to feed, considering the various herd and milk production factors, is one recently conducted by J. B. Lindsey and J. G. Archibald, of the Massachusetts Experiment Station at Amherst. A report based on 3½ years of investigation covers work on two systems of feeding dairy cows. One involved the feeding of a relatively large amount of roughage and a relatively small amount of grain; the other involved the feeding of a relatively small amount of roughage and a relatively large amount of grain. The Station herd was divided into two comparable groups, designated as the high roughage and low roughage groups. The high roughage group received approximately 1 pound of grain for each 4½ pounds of milk produced, plus 35 pounds of silage and as much hay as they would clean up. The low rough-

age group received approximately 1 pound of grain for each 2½ pounds of milk produced, plus 20 pounds of silage, and hay as for the first group. All cows used in the test were Holsteins and were divided so that their butterfat test was about comparable.

The digestible protein content was equalized for the two groups in order that each would receive about the same required protein intake. The high roughage group received a concentrate mixture consisting of the following percentage ratios, wheat bran 20, ground oats 15, corn meal 15, gluten feed 25, and cottonseed meal 25. It had an average digestible protein content of 17.9 percent. The low roughage fed cows received a mixture of the same feeds used in the following ratio of percentages, wheat bran 20, ground oats 25, corn meal 30, gluten feed 15, and cottonseed meal 10. The digestible protein content of the latter mixture is 12.8 percent.

In discussing the difference in nutrient intake amounts the investigators point out the important consideration that the discrepancy is due in some measure at least to an inherent weakness in the high roughage system of feeding. The cows would not, or could not, consume sufficient roughage to meet their standard nutrient requirements when the amount of grain fed was kept as wide as 1 pound for each 4½ pounds of milk produced daily. Superior quality of the nutrients supplied in the concentrate ration was also a possible contributing factor to the better returns from the low roughage-high grain group. It was emphasized that a high roughage system of feeding will not give as satisfactory returns as in this test unless the roughage fed is of good quality.

Among the results noted it was mentioned that the cows in the low roughage-high grain group maintained their general appearance rather better than those in the high roughage group. The cows in the low roughage-high grain group made larger gains, had better coats and more thrifty appearance. They made more efficient use of feed consumed, requiring 7 percent less dry matter and 2.7 percent less total digestible nutrients to produce 100 pounds of milk. They also maintained their milk production from year to year somewhat better than did those in the high roughage group.

Price per ton may be deceptive, relative to comparative price per 100 pounds of total digestible nutrients contained in a given feed. If mixed commercial concentrates of comparable protein content are being considered for possible purchase one may be priced at $42 per ton and an-

other at $44 per ton. It is not uncommon to find two 20 percent dairy mixed feeds relatively so priced, one of which may contain a guarantee of 1,475 pounds of total digestible nutrients at $44 per ton; and the other priced only $2 less having a guarantee of 1,325 pounds of total digestible nutrients. The prospective purchaser may decide to buy the lower priced feed, and assumes a saving has been made. However, an examination of the feeds based on their respective price per 100 pounds of total digestible nutrients presents an entirely different answer. If total digestible nutrients per ton are divided into tonnage price it is seen that digestible nutrients in the $44 ton feed are being purchased at the rate of a fraction over $2.30 per 100 pounds, while digestible nutrients in the $42 ton feed are costing just a fraction under $3.17 per 100 pounds.

We must constantly keep in mind that with equal protein content total digestible nutrients are the most important components of a given feed, having significance relative to cost production, provided common requirements and standards are met.

It would, of course, be possible to compound a feed which would excel in the matter of total digestible nutrients, yet such a feed could be very deficient in such matters as palatability, bulk, suitability and other essential requirements. The guaranteed fat and fiber content of a given feed are to considerable extent indicative of the desirability of the feed, within limits, and also as to the total digestible nutrient content.

Experimental work has shown the desirability of having the fat content of the concentrate feed not less than 4 percent, and fiber not more than 10 percent. Usually commercial mixed feeds with a fat content of 4 percent and a fiber guarantee of not over 9 to 10 percent will contain on the average about 1,475 pounds of total digestible nutrients per ton. General requirements should then include such considerations as comparative cost of 100 pounds of total digestible nutrients. The digestible protein content also should be of good quality and in such percentages as are needed to supply required amounts in accordance with proven standards for body maintenance and production. The percent of protein content needed in the concentrate ration will be principally influenced by the kind and quality of roughage consumed. Experimental tests show that with good legume roughage a concentrate protein content of 16 to 18 percent is adequate.

Specific physiologic requirements relative to certain individuals and their needs may and

probably do play a more important role than group experiments have been able to demonstrate. Generally speaking, some variety in the dairy concentrate ration is considered desirable. However, quality of the feeds consumed is probably a far more important factor, especially as it may influence variety.

Minerals and vitamins in sufficient amounts to meet daily requirements are essential. Young calves may need daily amounts of cod liver oil or other vitamin rich concentrates added to their milk to supply necessary vitamins. Good quality legume hay seems to supply most known required vitamins for mature and growing animals. Forced feeding of large amounts of minerals is not desirable; however, daily requirements of calcium, phosphorus, sodium, chlorine, and iodine should be constantly supplied. If 20 pounds of iodized stock salt and 20 pounds of steamed bone meal are added and well mixed with each ton of home mixed concentrate feed it has been shown to be beneficial. If livestock need more of the minerals mentioned they will consume such amounts as are needed to meet their own individual taste and needs, provided a suitable mineral mixture is kept constantly available for all livestock in a clean dry container. Equal parts iodized stock salt, ground limestone and steamed bone meal is a good mineral mixture. In spite of this generally known necessity it still remains probably the most frequently neglected farm feeding factor. Often livestock, especially young stock, is salted only on periodic visits to the pasture. Such a practice is followed primarily for the purpose of gentling the animals and having them so salt hungry they will come on call. Individuals so handled are usually unthrifty, and inclined to be wasp-waisted with a harsh rough coat. Access at all times to salt, consumed as desired, for all livestock will pay larger dividend returns than any other feed factor.

A good dairy concentrate mixture should weigh approximately one pound per quart. Oats and wheat bran should be used to some extent at least in mixed feeds, and especially for breeding animals. Some of the best and most successful livestock breeders and dairymen never use less than 10 percent wheat bran and 20 percent of oats in all feed mixtures. Succulence is desirable, but not essential, especially if the hay used is of good quality.

Guard Against Soft Pork

Condensed from Agricultural Situation

John W. Klein

HOG producers this year will need to take unusual precautions to avoid an increase in production of soft pork —and the price discounts that usually go with it—as a result of record acreages of peanuts and soybeans.

Protection against market losses from soft pork is a community affair rather than an individual problem under prevailing market practices. Soft pork cannot be detected in live hogs, because the fat is fluid at body temperatures. Therefore, a market receiving an appreciable quantity of soft hogs from an area, usually discounts all hogs from that area—no matter how careful any individual producer may have been. It is also of national interest to make sure that adequate supplies of firm carcasses are available for shipment overseas to our armed forces and our Allies.

The bacon from soft carcasses is greasy and hard to slice; the lard does not harden at ordinary temperatures; the loins and hams are not firm. Such products are particularly unsuited for use by troops in the field, or under any other condition where refrigeration is difficult.

The undesirable effects of feeding excessive quantities of whole soybeans are not confined to pork products. Soft butter may result from feeding ground soybeans to dairy cattle if they make up more than one-fourth of the concentrates. On the other hand, soybean oil meal can be fed to dairy cattle without affecting the hardness of the butter. Feeding tests have indicated that the soybean meal is fully as valuable as linseed meal, cottonseed meal, or ground soybeans in the dairy ration.

Care in feeding—particularly in the soybean areas of the Midwest and the peanut areas of the South—will fulfill a double-barrelled objective. It will assure carcasses suitable to meet the requirements of lend-lease buying; and it will assure maximum extraction of oil from peanuts and soybeans, to meet other food and military needs.

Oily feeds, such as whole peanuts, whole soybeans, mast, rice bran, rice polish, and flaxseed usually will cause a soft carcass if they form more than 25 percent

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of the ration. The body fat which hogs make from the nonfat elements of their feed is solid at room temperature, whereas the fat in these oily feeds is not. Since the fat in oily feeds is digested with little change, the degree of softness of the carcass will depend on the proportions of these fats.

The greatest danger of producing soft pork is in areas where it is common practice to hog off peanuts or to feed soybeans whole. The simplest safeguard is for the hog producer to sell his peanuts or soybeans to the processor. Once the oil has been taken out, there is no danger of soft pork from feeding the cake or meal. In fact, soybean and peanut cake and meal contain large amounts of protein and will afford a valuable supplement to the ration—especially in areas where there is commonly a shortage of protein feeds. Soybean hay and peanut hay, incidentally, will make a valuable feed for other classes of livestock after the soybeans or peanuts have been threshed out.

Prices of both peanuts and soybeans are so high that it would clearly pay farmers to harvest and sell these crops and buy corn rather than to feed them directly to hogs. In May, 1942, peanuts for oil were worth about 4.1 cents a pound and soybeans about 2.9 cents, as compared with 1.8 cents or less for corn. Harvesting and picking costs of peanuts, which are avoided when the crop is hogged down, are only about 1.0 cent a pound.

A less common cause of soft pork is light feeding. When a hog is not finished or is finished too slowly, the carcass will grade soft. Corn, which represents more than 75 percent of all the feed fed to hogs, contains 4 percent by weight of a fat which is liquid at ordinary temperatures. With a light ration little fat can be produced and most of it will be from the fat in the grain. However, light feeding should be less common this year than last because it is now profitable to feed hogs to heavier weights. The present hog-corn ratio is 17 compared to 12 a year ago.

In the South, the discount for soft carcasses is usually from $0.50 to $1 per 100 pounds. The discount might be even more severe if a limited market willing to pay premium prices for "peanut-fed" hams had not been developed. The discount may run up to $2 or more whenever large supplies of soft hogs are received. In the Midwest the discount is usually higher still, because there is no satisfactory outlet for the soft carcasses and the markets prefer not to have them at any price.

How Accurate Are Chemical Tests of Soils?

Condensed from Pacific Rural Press

John S. Burd

Professor of Plant Nutrition, University of California

THE term "availability" of plant food in soils is frequently misused in the agricultural press and even in scientific journals. Current usage often seems to imply that definite amounts of nitrogen, potassium or phosphate are present in each and every soil in a state or condition permitting their immediate absorption by plants. This is very far from being true. The fact is that the removal of the various elements (plant foods) from the soil by plants, is determined by many factors of which the kind of chemical compounds or soil aggregates is only one, although a relatively important one.

The nature of the plant being grown and the so-called "supplying power" of the soil for other elements exercises an important influence upon the amount of each element that a plant can remove. Thus, phosphate is absorbed by buckwheat from a given soil in greater quantity than it is by tomatoes, and similar differences are shown by other plants, both with respect to phosphate and to other important soil substances. Moreover, plants of the same kind will usually remove more of one element if an abundant supply of some other element is also absorbed. Thus potassium will usually be absorbed in greater quantity by plants if the soil is fertilized with nitrogen than if it is not so fertilized. There are a number of reasons why this should be so, but the most obvious one is that nitrogen generally increases plant growth and the larger root surface produced ensures contact of the plant with *more* soil particles.

If these statements are true, it follows that the most realistic tests of availability of any given element (plant food), is the amount of it which is removed from unit quantity of soil by the particular kind of plant which the farmer proposes to grow. A so-called physiological test (Neubauer soil test) applies this idea in part. In this test soils are compared and rated according to the extent that young rye plants, grown for brief periods, take up more or less potassium or phosphate from the individual soils experimented with. The conventional nature of such a test pre-

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cludes the possibility of interpreting the results very narrowly, since it is obvious (from what has been said above), that other plants than rye might remove more or less of these elements than does the rye.

Nevertheless if the Neubauer soil test gives comparatively *high* figures for absorbed potassium on any soil, such a soil is not very likely to respond greatly to potassium fertilizers. Conversely, *very* low figures usually indicate that potassium fertilizer can be used to advantage even for many other plants than rye. When intermediate figures are obtained, and this is very frequently the case, a soil giving relatively higher figures may need fertilizer more than some other soils yielding lower figures.

It would seem on superficial consideration that if such a test works well for potassium it ought to work equally well for phosphate. This does not necessarily follow, however, and it is a fact that the indications of this test for phosphate fail so often that it cannot be regarded as very reliable. This discrepancy has extraordinary interest to the scientist but cannot be profitably analyzed for the purposes of a popular discussion. It may be stated, however, that an explanation of this difference may be found when we obtain the results of certain proposed experiments, involving a study of the kinds of organic acids given off by different species of plants.

The most convenient, rapid and cheapest tests of soil to indicate availability of certain plant foods are extractions with dilute acids for which, (for technical reasons), hydrochloric acid seems most appropriate. It must be admitted, however, that taken alone and as frequently applied, such soil tests fail all too frequently. It is the writer's opinion, however, that this type of soil test can be extremely valuable when supplemented with other soil data absolutely essential in most cases, for the interpretation of the results of the extractions.

The facts which justify these acid extraction soil tests are very simply explained. Most soil minerals are so stable that they only release potassium and phosphate to the water of the soil to a slight degree and plants would languish or die in the great majority of soils if there were no other agent than water to dissolve *or otherwise release* important plant foods to the plant. All plants as a result of root respiration, give off large quantities of carbon dioxide gas to the soil and this *tends* to make the soil water and the surfaces of the plant roots slightly acidic. The soil as a whole may not become measurably acidic because the acid is neutralized to a greater or less degree when it acts upon

the soil minerals and different soils vary widely in their power to do this.

Plant roots also give off small quantities of organic acids from their absorbing root hairs or from dead cells which are sloughed off during growth. We really do not know much about these acids and they have not been very systematically investigated because it seems likely that in so far as producing *acidity as such* is concerned, they exercise but little influence compared with the enormus amounts of carbon dioxide given off by the roots. In any event many soil compounds undoubtedly give up their elements (plant foods) largely as a result of the continuous release of small amounts of weak acid in the zone between the individual soil particles and the root surfaces.

Acid extraction tests are merely an attempt to imitate the effects of plant roots, using the same kind of agency that the plant roots have at their disposal. We do not expect to extract from the soil the same amounts of potassium or phosphate that would be taken up by the roots of the plants. But we do hope to show the relative power of soils to release these elements when exposed to quantities and intensities of acid which careful studies suggest should act somewhat like the plant acids. The amounts of potassium or phosphate thus extracted are thus only index figures, the significance of which can only be established by extracting a large number of soils and comparing the figures obtained with the yield actually obtained when plants are grown on same soils.

On first impression it might seem that acid extractions ought to yield index figures which would indicate potassium availability because *all* potassium compounds tend to react with acids. Unfortunately, however, the tendency of potassium to be released by acids from any individual soil particle is affected by the ratio of the potassium to other elements of the same chemical type (calcium, magnesium, sodium); which ratio varies in different soils.

The acid extraction test does not reveal these ratios nor certain other values which might not affect the figures obtained in the laboratory but which could affect the power of the plant to dissolve potassium in the field. On this account an acid extraction soil test, taken alone, only indicates potassium availability or unavailability with any degree of definiteness when the figures are unusually high or unusually low. A closer indication can only be obtained by extensive chemical investigations which are not usually economically feasible.

When we turn to phosphate,

experience shows that acid extraction soil tests give a pretty good indication of availability for certain (chemical) types of soils but not for others. Recent investigations in this laboratory have shown why this must be so. The fact is that the phosphate compounds of the soil are of two general classes: Those which tend to dissolve in acids; those which tend to hold on to their phosphate the more they are acidified (within limits likely to occur in soils). Now, it is an interesting and significant fact that this latter class of phosphate complex which does not dissolve in acids as such will release phosphate to certain kinds of acids. It will also release phosphate to plants in greater or less degree depending upon the kind of plant grown and upon the amounts of the substances which hold the phosphate in an acid insoluble condition. If such substances are present in substantial amount, the acid extract, as usually carried out, may give low figures but the plant may get phosphate if these particles are highly saturated with phosphate. In other words, we cannot interpret the results of phosphate extraction of certain chemical types of soil without a considerable investigation of other soil characteristics.

If we do make these additional determinations (or tests) they give valuable indications of acid extractions. In fact we have come to believe that with the supplementary procedures recently devised it is now possible to form an opinion, from chemical tests alone. We can determine whether plants in general are, or are not likely, to respond to the application of phosphate fertilizers to the soils tested. It must be emphasized, however, that such an opinion has definite limitations if plants of very superior or very inferior acquisitive powers are to be grown.

It should now be obvious that predicting the fertilizer needs of a soil requires a good deal more than merely shaking up a soil sample with a little acid and finding out what comes into solution. For most soils five different tests (determinations) seem to be essential to justify an opinion as to what may be called the potential availability of their phosphate, or the desirability of adding phosphate fertilizer. Furthermore it should be pointed out that there *is* not and probably never will be any way of combining (integrating) the various index figures in a single master index figure which will give the right answers.

The significance of the figures for any given soil can only be interpreted in the light of extensive studies of large numbers of soils whose specific needs for

phosphate have been determined in controlled experiments with plants of different specific absorbing capacities.

It is evident that acid extraction soil tests can only be expected to give indexes of availability for those soil substances which tend to dissolve in or react with acids in such a way as to release their elements from the soil particles of soils. Such a method would not be applicable to nitrogen because nitrogen availability does not depend upon solubility in acids but upon the activities of soil organisms, bacteria, etc.

Opinions as to nitrogen availability must be based on other types of tests (biological), a discussion of which does not come within the scope of this article.

Butter Stored Six Years

Butter may be successfully stored in sub-zero temperatures for a period of six years, it is claimed by investigators at Cornell University after taking butter out of the coolers where it had been stored for that period of time.

Six samples were treated differently and at the end of the six-year period one tested 92.3. It was pointed out that if England had been able to use the process prior to the time the war began, butter would not be one of the most severely rationed foods in the British Isles. No announcement was made of the procedure used for the one sample.

—*Canadian Ayrshire Review*

An Enemy of Root-Knot Nematode

Condensed from Texas Farming and Citriculture

C. W. McBeth

U. S. Bureau of Plant Industry

A LEGUME which is already known to have great value as a summer cover crop and now has been found equally valuable in combatting the root-knot nematode is Crotalaria Spectabilis.

Although practically all other legume cover crops — cowpeas, velvet beans, soybeans, etc.—are susceptible to nematode attack and actually increase any nematode population present, C. spectabilis, on the other hand, greatly reduces the number of root-knot nematodes in the soil. The fact that it is not palatable to livestock adds to its value, as the temptation to graze or cut for hay is not a problem.

In order to study and compare the value of C. spectabilis in reducing the root-knot nematode population, an area known to be infested, approximately one acre, was divided into sixteen equal plots arranged in a latin square and given the following treatments, four replications per treatment:

1. Clean cultivation—Soil kept bare winter and summer.

2. Trap crop—Several plantings of whippoorwill cowpeas were made during the summer, each crop being destroyed before the nematode became mature. No cover crop in the winter.

3. Susceptible cover crop—Whippoorwill cowpeas in the summer and Austrian winter peas in the winter.

4. Root-knot resistant cover crop—Crotalaria specabilis in the summer and oats in the winter.

After the above treatments had been in effect two seasons, nematode population counts were made by planting cucumbers in the plot as indicator plants. Twenty-five plants from each plot, or 100 from each treatment, were taken at random and the roots examined for root-knot nematodes under the microscope. The results are as follows:

Treatment	No. of Plants	Root-Knot % Infected	Nematodes Per Plant
Clean cultivation	100	1	1.17
Trap crop	100	3	1.75
Susceptible cover crop	100	100	105.00
Resistant cover crop—			
C. spectabilis	100	0	0

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As can be seen in the above table, the indicator plants taken from plots on which C. spectabilis had been grown for two years, were entirely free of the root-knot nematode, while the plants taken from the root-knot susceptible or cowpea plots were 100% infected.

The indicator plants taken from the clean cultivation and trap crop plots indicate that the nematode population can be held down by these two practices, although neither is practical in most cases. It is a well known fact that clean cultivation is detrimental to the soil, especially during the summer, besides leaving it exposed to erosion by wind and water. Trap cropping is not practicable to the ordinary grower as it requires careful timing as to when the crop should be destroyed. If the trap crop is left a day or so too long, the population will be increased instead of decreased; also, every plant must be destroyed or the trapping effect is lost.

In addition to the above experiments, C. spectabilis was grown in the greenhouse in 1′ x 3′ x 3′ boxes. The soil was artificially inoculated with root-knot nematode eggs and larvae by mixing with heavily infected cowpea and tomato roots. Root samples of C. spectabilis were taken at intervals of one week and examined microscopically by the lactophenol acid fuchsin staining method. Although a limited number of root-knot nematode larvae were found in the root tissue, no mature egg producing females were present.

Conclusions

Crotalaria spectabilis, grown in root-knot nematode infested soil, will reduce a root-knot nematode infestation to a minimum, and in addition is one of the best soil building summer legumes available. C. spectabilis produces seed abundantly in the coastal plain area. Both early and late varieties have been found to be equally valuable in controlling the root-knot nematode.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. The Macmillan Co. $4.00.

Breeding Your Own, or Raising Colts for Pleasure and Profit—By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Conservation in the United States — By Gustafson, Ries, Guise and Hamilton. Comstock Publishing Co. (1940). $3.00.

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. The Macmillan Co. $3.90.

Electricity in the Home and on the Farm—By Forrest B. Wright. John Wiley & Sons, Inc. $2.75.

Farm Accounting—By Donald R. Mitchell, Asst. Prof. Agri. Economics, Univ. of Wisc. McGraw-Hill Book Co., Inc. (1941). $2.50.

Farm Shop Practice—By Mack M. Jones, M.S., Prof. Agri. Engineering, Univ. of Mo. McGraw-Hill Book Co., Inc. $2.75.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. The Macmillan Co. $2.90.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State College. Collegiate Press. $2.50.

Farm Management and Marketing—By V. B. Hart, Ext. Professor of Farm Management; M. C. Bond, Ext. Professor of Marketing; L. C. Cunningham, Ext. Asso. Professor of Farm Management; all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. (1942). $2.75.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Fruit Crops—By T. J. Talbert, Prof. of Horticulture, Univ. Mo., and A. E. Murneek, Asst. Prof. Horticulture, Univ. Mo. Lea and Febiger. $3.75.

Hunger Signs in Crops—Published by the American Society of Agronomy and The National Fertilizer Association. $2.50.

Home Vegetable Gardening—By Charles S. Nissley, Extension Horticulturist in Vegetable Growing. Rutgers Univ. Press (1942). $1.50. $1.50.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Judging Handbook—By Julius E. Nordby, Asst. Prof. Animal Husb., Univ. Idaho, and W. Malcolm Beeson, Ph.D., Asst. Prof. Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw-Hill Book Co., Inc. $4.00.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Practical Poultry Management—By James E. Rice, Emeritus Professor of Poultry Husbandry, and Harold E. Botsford, Extension Professor of Poultry Husbandry, both at New York State College of Agriculture. Fourth Edition (1940), John Wiley & Sons, Inc. $2.75.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.

Some Common Diseases of the Horse—By George R. Conn, B.S.A.H., D.V.M., Orange Judd Publishing Co., Inc. (1942). $1.50.

Some Common Diseases of Cattle—By George R. Conn, B.S.A.H., D.V.M. Orange Judd Publishing Co., Inc. (1942). $1.50.

The Nutgrowers Handbook—By Carroll D. Bush. Orange Judd Publishing Co., Inc. $1.75.

The Western Horse—Its Training, Type and Marketing. By John A. Gorman, Asso. Prof. Animal Production, Univ. of Wyoming. The Interstate Printers and Publishers. $1.65.

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. McGraw-Hill Book Co., Inc. $5.00.

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The subscription price is $1.50 for one year, $2.50 for two years and $5.00 for five years.

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